Assessment of the best theories of collaboration for conducting academic-industry collaborations in the pharmaceutical industry

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MSc in Pharmaceutical Business and Technology (QQI)

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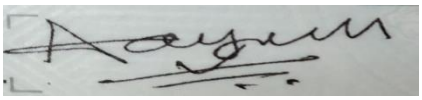
I certify that the dissertation entitled:

Assessment of the best theories of collaboration for conducting academic-industry collaborations in the pharmaceutical industry

submitted for the degree of MSc in Pharmaceutical Business and Technology is the result of my own work and that where reference is made to the work of others, due acknowledgment is given.

Candidate signature: 

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Abstract:

Research question: What are the best theories of collaboration for conducting academic-industry collaborations in the pharmaceutical industry?

This thesis assesses the best theories of collaboration necessary to conduct academic-industry collaborations in the pharmaceutical industry. It involved conducting interviews for both, academic and industry professionals, which provided deep and impactful insights about how each side of the collaboration operates and works in union with one another to achieve targets and accomplish project goals.

In order to better understand the best theories of collaboration, it was necessary to include the history of what academic-industry collaborations are and the key challenges involved in academic-industry collaborations in the pharmaceutical industry and in other industries. Theories of collaboration were further explored, including how their themes have been applied earlier in academic-industry collaborations in other industries, but focuses particularly on those that functioned in the pharmaceutical industry.

The professionals included academic chairs, senior academic professors and researchers, as well as industry professionals. The approach to gathering information was based on a narrative analysis approach, which was framed on the basis of gathering the stories and experiences of the participants in this dissertation study and was interpreted on those grounds.

A total of 4 professionals from the academic side and 4 from the industry side were interviewed, wherein their experiences and stories from their career progression in academic-industry collaborations in the pharmaceutical industry was analysed and coded for determining whether the selected theories had impactful contributions for resolving the challenges identified.

The findings, including the importance of themes being used in combinations and the prevalence of some themes over others in resolving certain challenges fell in line with the literature review conducted and has supplemented the research objectives and the established research question.

The professionals explained what their best collaborations were, the greatest challenges they faced, their history of being involved in academic-industry collaborations and the quantity and quality of their work experience, which enabled them to conduct such collaborations. The theories included in the literature review were applied to the in-depth interview findings, and there was a strong link found between the theories of collaboration and the most successful collaborations conducted by the interviewed professionals.

This is an area that still requires a lot more research to understand as to how academia and industry need to collaborate, how should the conduct and mindset of those involved in such collaborations be, and what exactly are the best theories of collaboration for conducting such collaborations.

Keywords: Collaboration, trust, networking, stakeholder focus, academia, industry, organizational, theories, conducting, challenges, common, goals, knowledge, sharing, quality, management, themes, pharmaceutical, academic, resolving, application, best, assessment, conducting, applying, overview.

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1.1 Overview:

"Alone we can do so little, but together we can do so much"- Hellen Keller

Collaborations between academia and industry in the pharmaceutical industry are needed for achieving world-class products, using cutting-edge technology and for allocating a copious budget for such projects. However, even with the best of technology and the largest of capital investments, most collaborations are subject to setbacks, delays and failures. Culture is a highly ignored factor, which is the backbone for guiding and completing collaborative projects (Rowlands *et al.*, 2006).

There are many such elements other than culture, which ensured the most applicable themes and elements were applied for the best of collaborative results. However, there are still more aspects that can applied to these collaborations, such as theoretical knowledge that is transferrable to practical situations of this sort (Rowlands *et al.*, 2006).

As I have a background in pharmaceutical sciences, with an experience in clinical trials pertaining to generics drug development, this topic was of deep interest and intrigue. Previous upskilling had left me pondering on academic-industrial collaborations in the pharmaceutical industry, making it all the more alluring. Pursuing this topic helped in understanding further the topics and experiences that were left unexplored.

This symbiotic relationship is further explored in a conference, namely the Stroke Therapy Academic Industrial Roundtable (STAIR), which discussed the mode of developing a therapy for acute stroke patients, and drug development of the medication used to diminish the same, that was tested in acute stroke clinical trials later. Participation of both parties and their agreement on the protocol proposed in a timely manner is key to a robust development plan. Prior introduction must be applied to all the phases from early designing, all the way until successful drug development, and in clinical trial reporting as well (Fisher, 2003b).

Problems in collaborations arise due to a lack of communication and understanding between the two parties. Although the hypothesis of the research studies and the inner drive for achieving results are factors that the two have in common, the causation of the existence of a fissure between the two stems from differences in culture, goals and principles that guide each party to perform tasks. It was found that the primary factor that creates obstacles for the two parties is the end goal that each party considers to be a successful triumph in their attempts. Academic researchers are more aversive towards sharing research data with industrial scientists than they are with their peers and seniors involved in their domain (Birnbaum, 2016).

The main focus of both parties is to foster trust, and to mainly work towards helping out the greatest asset that they have; their stakeholders. A patient-centric approach in conducting such collaborations has been proven to be rather fruitful for achieving outputs and marking such as collaborations in history as not only being successful, but also establishing themselves to socially responsible (Radleys, 2018c).

It has become a wildly emerging trend as of recently for academic-industry collaborations to seek advice and consultation from the opinions and needs of patients around the world. According to the clinical research giant Covance, the incorporation of patient opinion in the design and conduct of clinical drug development has received a vastly large proportion of nods from senior professionals involved in the same (Radleys, 2018c).

1.2 Research Purpose:

The research purpose of this dissertation was to discover the best theories that can be applied for conducting academic-industry collaborations in the pharmaceutical industry.

These collaborations are filled with a range of challenges and hurdles that make it difficult at times for collaborators to achieve significant results that have a positive outcome on stakeholders and on society as a whole, as revealed in the literature review.

The determination of the best possible theories of collaboration for overcoming these challenges is a highly important milestone that this study has achieved, which has ensured that any collaborations in the future can benefit from the generated findings to prevent past and current challenges in academic-industry collaborations.

1.3 Significance of the Study:

The study conducted was successful at establishing the importance of academic-industry collaborations and how the two have collaborated efficaciously by implementing certain themes that have been identified from the best theories of collaboration chosen, and have key factors in mind, which have been or are being applied in practice, proven to aid in seamlessly collaborating with either party.

This study has aided in instilling all the necessary factors for conducting academic-industry collaborations with the best theories of collaboration needed, as this study explores a vast number of reasons to collaborate, how challenges are overcome and what are the elements necessary in establishing and conducting such collaborations more effectively, as determined by the exploration of the theories of collaboration.

The research being conducted will benefit industry researchers, academia researchers, industry executives at both ends of the collaboration, but will most of all be beneficial for the stakeholders for whom this collaboration was set; patients.

This is as the dissertation carried out helped in identifying the factors and sources that are responsible for creating hurdles between academia and industry, and has paved a pathway to overcoming them and using specific themes and principles derived from the theories of collaboration explored that ensures a smooth flow of operations, producing promising results and outcomes, and most of all a culture for conducting synergistic operations in such academic-industry collaborations.

This dissertation explores the various theories of collaboration used before, in use currently and those that can be used by academic and industry collaborators in collaborations to ensure that the collaborative activities conducted are as feasible as possible, free from errors to a large extent, and that they follow a set of themes and principles explained in the same that are proven and trusted, which creates a strong culture and fosters long-lasting relations during and also after the completion of such a collaboration.

Various insights from highly experienced researchers, academic chairs, industry leaders and consultants in the pharmaceutical industry have been gathered by in-depth interviews, which have strong and ardent opinions and experiences, revealing the most feasible

theories of collaboration necessary for conducting academic-industry collaborations in the pharmaceutical industry.

1.4 Research Objectives:

- To gain insights on the challenges faced in academic-industrial collaboration in the pharmaceutical industry: The challenges faced in academic-industry collaborations have been chosen as they have provided me with areas where solutions need to be applied, based on the history of academic-industry collaborations explored in the literature review and it has also aided me in identifying the areas where the themes from theories of collaboration can be applied to resolve the same.

- To understand and explore the theories of collaboration and their themes that supplement academic-industry collaborations: The selection of theories of collaboration have been based on their applicability in resolving the explored challenges identified and the themes that form the theories, which hold potential for providing solutions for overcoming the explored challenges.

- To analyse and determine the degree of applicability of the theories in academic-industry collaborations in the pharmaceutical industry: The degree of applicability was assessed on the basis of the primary research conducted, which was interpreted on the basis of the challenges the participants faced, the solutions they used, and the degree of similarity their solutions held with the themes from the theories of collaboration that were selected and explored in this dissertation study.

1.5 Structure of the Study:

The study conducted has used the approach of interpretivism, which collected data by means of in-depth interviews. The study involved designing specific questions that were tailored to retrieve information from both, academic and industry professionals involved in collaborative activities presently and in the past, in the form of stories and experiences, analysed by a narrative analysis approach.

A background on academic-industry collaborations has been explored, followed by the reasons for their importance. The different kinds of challenges presented in such collaborations have been explored by me in this dissertation study, followed by the selection of specific theories of collaboration that contained themes that were applicable for resolving the selected challenges efficaciously.

The primary research conducted after the completion of the literature review study enabled the retrieval of qualitative data from both parties, aiding in the clarification of how their experiences have influenced the collaborative activities in the process of the collaborations involved that have bolstered the outcome as a result of effective theories of collaboration that have been deemed essential and necessary for harvesting the true potential of collaborating in the pharmaceutical industry.

Academics have been questioned on the same aspects as industry professionals, which has helped in understanding the differences in opinions, experiences and beliefs that each side of the collaboration have in the process of collaborative activities.

Industry professionals have been interviewed with a set of questions that were entirely fixated on their perspective of the collaboration, as done in the case of academia. The questions in this section have been designed in a manner that allowed the me to receive responses fixating on the importance of particular theories of collaboration that have yielded the best results in collaboration, designed around a narrative analysis approach.

The study being carried out has chosen a number of theories, explored literature to analyse unmentioned themes regarding essential characteristics (i.e. trust, networking, collaborating, stakeholder focus, total quality management), and has applied these in practice by conducting in-depth qualitative interviews with senior academic researchers, university chairs, highly experienced executives and consultants, who have provided detailed insights from their own knowledge and experiences gained over the course of

years, and this has provided a significantly solid foundation for exploring various theories of collaboration essential for conducting academic-industry collaborations.

1.6 Conclusion:

As the importance of academic-industry collaborations is profound not just before and as of today, but its true need is being denoted by a large surge in the number of such collaborations being established for the foreseeable future, as explored in the literature review.

The best theories of collaboration most suitable to academic-industry collaborations in the pharmaceutical industry have been chosen, tin order to ensure that capital and time invested in such collaborations are not drained away, the morale of those involved in such collaborations will be reduced due to unexpected and unprecedented outcomes, as explained and explored in the literature review.

The best theories of collaboration have been explored and the most suitable themes have been determined, subsequently applying those to such collaborations in the primary research.

The chapter explores the prologue of the onset of academic-industry collaborations, the importance held by themes in establishing the conduct of such collaborations, and what are the different problems that can hinder academic-industry collaborations. This approach has permitted me to further explore in depth, the history and description of academic-industry collaborations are, why they are important, what are the different challenges faced in their conduct and how can they be overcome, by the application of relevant theoretical themes and principles.

The following chapter explores the essence of what academic-industry collaborations are, what their true significance is, what are the different challenges presented in these collaborations and how can they be resolved by the selection of the most applicable theories that are used to overcome the same.

Chapter II: Literature Review:

2.1 Introduction:

The literature review conducted is composed of three sections, namely the history and importance of academic-industry collaborations, the key challenges identified in academic-industry collaborations , and the exploration of theories of collaboration and their application in academic-industry collaborations in the pharmaceutical industry. This section has been designed to develop the true significance of theories of collaboration.

The first section explores the background and importance of academic-industry collaborations, which included the relevance they have had before, today and their importance in the future. Also, the reasons for conducting these collaborations have been explored by me in this dissertation study. This provided a backstory of the reasons for conducting this dissertation study and gave a strong foundation for me to work upon the following sections in the literature review.

The second section explores the key challenges in academic-industry collaborations, which is mainly those that have been identified in collaborations in the pharmaceutical industry and to a small degree, in other industries where the challenges posed were similar in nature to those in the pharmaceutical industry as well. These challenges in collaborations have been selected on the basis of identifying challenges related to a lack of networking, knowledge sharing, a diminished stakeholder focus, a lack of application of total quality management principles, flailing trust and uncommon goals.

The third section explores the theories of collaboration that have been effective at resolving challenges in academic-industry collaborations and the application of these theories of collaboration and the themes within them to academic-industry collaborations, particularly in the pharmaceutical industry. This approach involved identifying the same themes present in the theories of collaboration in academic-industry collaborations in the pharmaceutical industry, and how they manifest as solutions to overcoming the challenges identified in the first section.

The exploration of these theories and the identification of the themes that form the content in these theories provided me with solutions identified in the form of themes that have

been earlier proven to overcome the identified challenges in the first section of the literature review.

This approach enabled me to understand the significance of the explored theories of collaboration in academic-industry collaborations in the pharmaceutical industry. The application of these theories was able to resolve the identified challenges in said collaborations explored in the third section, which opened new opportunities for me to further explore their significance and resolving capacity at overcoming the challenges identified.

2.2 Background and importance of academic-industry collaborations:

Background:

Collaborations are the engine that drive the conduct and output of businesses by the development of robust strategies. Collaborations exist between businesses and their customers, suppliers and stakeholders. However, collaborations between industry and academia are not as frequent. The need for academic-industry collaborations is of paramount importance and is the need of the hour, as this partnership is the driver of inspiration and instils a culture of innovation. Small firms have collaborated with academia and reaped the benefit of more than a seventy percent increase in innovativeness in their products (Bangor, 2019a)

Academic-industry collaborations are a critically important partnership useful for driving innovation. They are needed for using the best of academia and industry by propelling knowledge sharing between the two. Academia is bound by its missions, namely the propagation of education, driving research for boosting innovation and to initiate a culture of entrepreneurship by creating spinoffs, which is assisted in greatly by the industry (Morisson, 2020h)

The premise of forming academic-industry collaborations is based upon the sharing of resources and expertise. Industry has large reserves of capital and workforce, whereas academia possesses extensive knowledge and subject expertise. Academic-industry collaborations have been formed in the fields of physics and chemistry but have relative importance in the field of biology (D'Abrantes, 2017).

The sharing of resources and the translation of the potential possessed by both academia and industry for forming world-class collaborations is to apply their expertise accordingly, in order to convert their inventions to innovation, based on utilising certain practices that lead to the same (Davidson and Lamb, 2000) .

Importance:

The advantages of forming such collaborations hold profound importance, some of which include robust career opportunities, research grants and elevated trend understanding from industry for academic professionals, while industry professionals gain strong networks, innovative thinking, upskilling, having the opportunity to hire new recruits and an open pathway to world-class cutting-edge resources (D'Abrantes, 2017).

The combination of academia and industry holds high significance in terms of bolstering not only the development and production of successful products, but also in imparting relevant knowledge to students and develop curriculums in universities for the most practical gain of knowledge and their consequent employability in the industry following the same. By initiating this kind of collaboration, it has been advantageous for university as students gain the best of knowledge and skills and the industry obtains the best employees consequently by conducting such a collaboration. Implications for improved exchange of technology and knowledge has also been established as a result (Mustafa, 2019).

Benefits from such collaborations are not only limited to academia and industry, but to society as a whole as well. Universities gain from the fact that industry selects graduates from their institutions after a joint collaboration with industry, and the credit for the same goes to academia's faculty and the quality of their programmes. This is a lauded strategy for increasing their significance in comparison to other institutions that have not deployed this strategy of collaborating. Industry's major advantages were found to be industry obtaining novel ideas for commercialising and saving capital by utilising academia's research expertise, as well as obtaining graduates for important roles in the industry. Society benefits as students are provided with best of education and jobs and the provided government grants are utilised to their best capacity. Although the benefits are profoundly significant, challenges presented in such collaborations are quite prevalent as well (DesJardins, 2019b)

2.3 Key challenges identified in academic-industry collaborations:

Lack of common goals:

One of the greatest challenges identified in academic-industry collaborations was a lack of understanding between the two parties. Although the hypothesis of the research studies and the inner drive for achieving results are factors that the two have in common, the causation of the existence of a fissure between the two stems from differences in common goals and principles that guide each party to perform tasks. In case of academia, the publishing of a study is the ultimate goal to be achieved, while pharmaceutical companies regard the development of a drug candidate that has advanced to be safe and efficacious enough to enter human trials as a milestone (Birnbaum, 2016).

The perspective of a lack of common goal is different for academia and industry. Industry states that academia does not regard their time deficit and does not contribute to the collaboration as swiftly as they should, which leads to extending timelines for the project. Also, the needs of the industry and their expectations outweigh the efforts put in by academia in the project, in industry's opinion. Academia has a fair share of goals that differ from industry as well, including their focus on education programmes, which industry does not regard up to academia's expectations (Şendoğdu and Diken, 2013).

Lack of knowledge-sharing:

Knowledge sharing is an aspect in academic-industry collaborations that is influenced greatly by other primary challenges that exist in such collaborations. Universities tend to have their own specialised policies and industry suffers from intraorganizational tensions, which influences decision making and reduces the prospects of transferring technical and essential knowledge regarding the collaborative conduct. Other than organizational and contextual factors, the degree of knowledge sharing is influenced heavily by the internal and external stakeholders involved. Conflicts between the two has a direct effect on the quality and frequency of decision making, hindering knowledge transfer between academia and industry as a result (Alexander *et al.*, 2020).

Intellectual property plays a major role in deterring knowledge sharing in academic-industry collaborations. Academia does not share knowledge regarding their research and novel ideas for innovation from the fear that their industry partners can gain a competitive advantage over them and utilise their innovative ideas for their own intellectual property. These branch out into more challenges over time, including a lack of trust and networking consequently (Fiaz and Naiding, 2012).

Lack of networking:

Networking-related challenges arise when there is a lack of a common understanding and goals between the involved parties in the collaboration. A lack of a shared vision and the unavailability of a standardized measurement tool for measuring performance related to the collaborative conduct are the main root causes of a diminished network in academic-industry collaborations (Rantala and Ukko, 2018)

Networking is essential for forming collaborative networks. Academia and industry need to have an adequate amount of trust and shared goals for establishing a prolonged network with one another. The reasons for a diminished networking regime in academic-industry collaborations occurs due to weak interorganizational collaboration practices and lack of a common vision for the output of the collaboration between academia and industry. (Roberts, 2019)

Networking works on the premise of trust. Flailing trust in academic-industry collaborations results in weaker networks and subsequent decimation of the foundation of networking (Hubrath, 2008a)

Lack of total quality management:

An unexpected factor came into play, which was the lack of a strong clinical research component. Clinical trials observed a sharp decline in the number of patient enrolments, a sharp incline in the time taken to plan the trial, increased rate of patient dropouts, and the departure of principal investigators after their very first trial, despite spending a plethora of funding on training and educating them. A lack of industrial quality management of contract research organizations and clinical research departments in the

organization not managing and planning projects with academia appropriately resulted in the above problems to become more profound in nature (Rosenblatt, 2013).

A quality management system needs to be implemented in academic-industry collaborations in order to ensure that the products and processes used are in line with the current regulatory framework. A lack of an effective quality management system leads to inconsistency in the output of the collaboration, in the form of wavering product quality. Quality management needs to be in line with the needs and demands of the customers, as well as the internal and external stakeholders involved in the collaboration. The major challenges faced in academic-industry collaborations with respect to quality involve a lack of consistency, failed output, lost capital in the collaboration, as well as loss of trust and morale from stakeholders (Kauppila *et al.*, 2015).

Lack of inter and intra organizational collaboration:

Inter and intra organizational collaboration refers to how individuals collaborate with professionals from the other side of the collaboration and within their own organization, respectively. It refers to how they perform as individuals and within a team. Individual performance (i.e. intraorganizational collaboration) challenges include taking credit, the degree of agreement they have with the culture of their own organization and how they network with and have trust in their own peers. This leads to severe delays in collaborations as individuals have personal problems with their organization, leading to additional delays and problems with those faced in their collaborative organizations as a result as well (Kyvik and Reymert, 2017).

Team-based (i.e. interorganizational collaboration) challenges include those pertaining to communication, trust, coordination and synchronism. If the team working together on the collaboration do not adhere to effectively communicating, trusting, having common goals and being in sync with one another, multiple challenges arise. These include loss of capital and time invested in the collaboration, reduced output, loss of trust from stakeholders and a direct impact on the credibility and respect of those involved in the collaborative efforts (Chiocchio *et al.*, 2012).

Lack of stakeholder focus:

Stakeholders in collaborations are of two types, namely internal and external stakeholders. The former are a part of the organization and include employees and shareholders, while the latter includes customers. Challenges related to stakeholders are quite complex and take into account the opinions of all stakeholders, both internal and external. Diverging opinions, lack of agreement on projects leading to unplanned and delayed collaborations, as well as diminished trust in academia and industry as a result of poor outputs creates a network of challenges in academic-industry collaborations. Insufficient fund flow is also regarded as a major problem in collaborations when stakeholder focus is low (Ayala-Orozco *et al.*, 2018).

A lack of stakeholder focus leads to the loss of an important common goal to exist between academia and industry. It has also been observed that stakeholder focus, upon diminishing, has led to a loss in innovation, competitiveness with other academic-industry collaborators and a loss in output of products, leading to massive losses in time and capital invested into the project (Fernandes *et al.*, 2016).

Lack of trust:

Trust is a factor that has a significant influence on many other important criteria's of conduct in academic-industry collaborations. A lack of trust has a severe impact on the aspect of knowledge sharing, networking and overall innovative processing and output in academic-industry collaborations. Trust related challenges have been found to be more prevalent in collaborations that are influenced by intellectual property related influence from academia, instead of focus being shifted upon common goals and knowledge sharing (Bstieler *et al.*, 2015).

Trust in collaborations particularly in the healthcare industry overall drives research and development productivity and innovation and leads to enhanced knowledge exchange. A lack of trust tends to render research and development efforts obsolete and diminishes knowledge exchange to a bare minimum. Loss of trust leads to weak delegation of responsibilities and increased problems, both personal and professional in the academic-industry collaboration. This has a serious impact on the collaborative output (Kerasidou, 2019)

2.4 Overcoming challenges in academic-industry collaborations:

Based on what was explored in the introduction, a number of theories of collaboration that supplement academic-industry collaborations have been chosen, as these are renowned and proven to enable partnerships of collaborative nature to be conducted in the most feasible manner possible.

I. Theory of Theorizing Collaborative Practice by Huxham:

This theory generated a number of themes as found in the findings provided. Huxham denoted that collaborations can be successful between parties only when trust, power and common aims were established in certain amounts, varying based on the theme. Figure 1 below describes the other themes that supplement power, trust and common aims, initiating the best collaborative conduct possible.(Huxham, 2003).

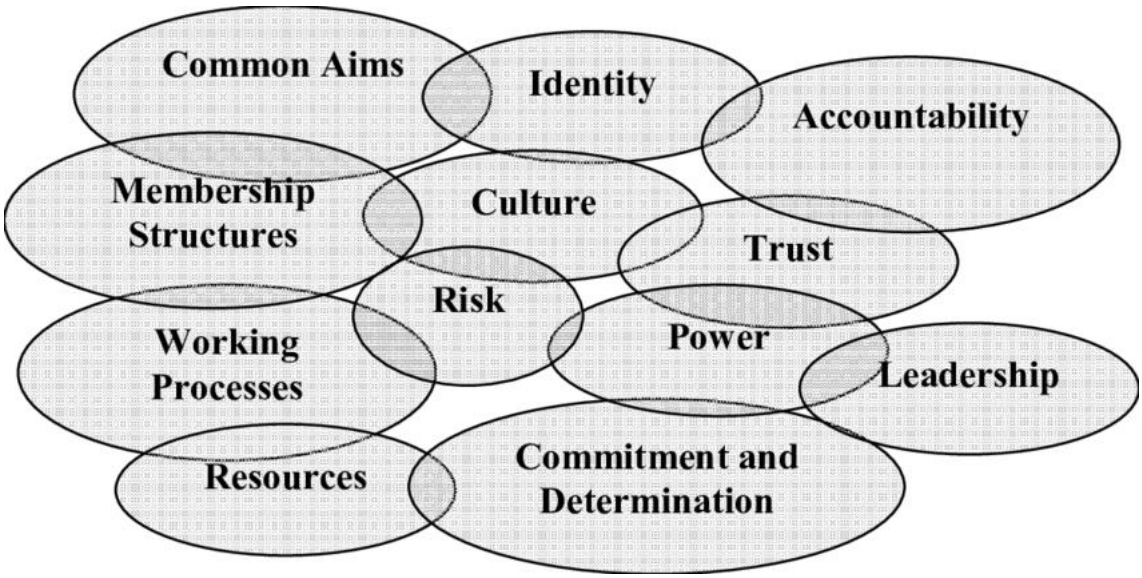

FIGURE 1 THEMES IN COLLABORATION (HUXHAM AND VANGEN, 1996C)

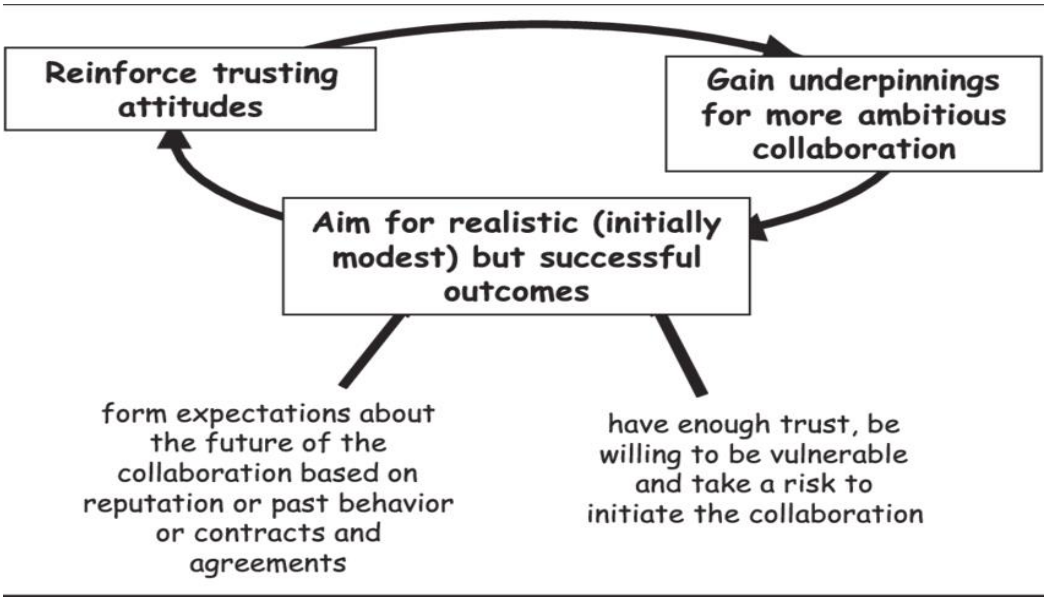

FIGURE 2 THE CYCLICAL TRUST-BUILDING LOOP (VANGEN, 2003B)

The challenges explored earlier have been overcome by the use of this theory, as explained in Figure 2 above. Common and realistic aims should be set, trusting attitudes are inculcated in the collaborative culture and underpinnings are obtained as a result and form the foundation upon which future collaborations can be conducted using the same methodology. This is further explained below.

Overcoming the challenge by application of theory:

University of Harvard is the forefront leader in this aspect, as they have stablished master agreements for multiple projects for academic-industry collaborations with the industry The director of communications of Harvard's technology transfer office, Caroline Perry has stated and explained that mutual understanding and agreement on projects builds trust as both the collaborating parties are on the same page, and this helps in initiating, propagating and achieving targets and outputs from said projects relatively quickly (Taylor, 2018).

The application of Huxham's theory of theorizing collaboration has been confirmed in practice to only be effective if certain important values are induced in the collaboration, which together have been found to lead to greater output, including increased risk-taking, preserving equity, bolstered communication and enhanced adaptation to situations in circumstances of adversity in the collaboration (Allford, 2017).

Applying the theory of Huxham in combination with the themes and principles of other theories of collaboration showed that trust is established further by prolonged experience. The longer the collaboration conduct lasts, the more the level of trust increases over time. This also helps in shaping relatively similar aims in academia and industry, leading to better collaborative conduct and subsequent outputs (Gazley, 2017).

Using Huxham's theory of theorizing collaboration, the themes of trust and common goals as explained were applied to create a collaboration workshop, which inculcated the principles of trust and common goals. This led to improvements in knowledge sharing, addressed previously undisclosed non-compliances and led to improved understanding in collaborations (Grove *et al.*, 2018).

II. Stakeholder Collaboration Theory:

This theory fixates on the importance of the relationships and collaborations that organizations have with their stakeholders. It fixated on the effects of stakeholder focus being regarded as a particularly important theme, and how their inclusion and exclusion affected the degree of success of an academic-industry collaboration. It was found that stakeholder focus has immense implications for establishing common goals between academia and industry, and leads to improved collaborative conduct as a result (Savage *et al.*, 2008).

Overcoming the challenge by application of theory:

Savage's theory was applied and tested in practice in collaborations, and it was determined that stakeholders involved in collaborations that are more supportive are regarded to be harbouring high cooperative potential, while those that were not actively supportive and had marginal involvement as stakeholders possessed low cooperative potential. The latter were found to be more resource dependant and power seeking in nature. Determination of the same allowed the application of these principles into academic-industry collaborations, leading to increased understanding of selecting and listening to the stakeholders that were more high cooperation oriented (Miles, 2017)

Management strategies should be formulated for the selection and inclusion of external stakeholders on the basis of particular attributes of stakeholders, which includes their degree of supportiveness. Further application of Savage's Stakeholder Theory in academic-industry collaborations confirmed that applying the principle of informing and collaborating strategies can be used to increase the involvement of supportive stakeholders and diminish the involvement of those that hinder collaborative conduct. A change control strategy should be in place for stakeholder management and involvement to prevent the same (Lehtinen *et al.*, 2019).

The pharmaceutical company Genzyme was swift in recognizing the importance of stakeholders in academic-industry collaborations, as a constant engagement with stakeholders led to bolstered clinical research conduct, more consistent and quicker drug regulatory approvals, and product pricing. Constant communication with stakeholders allowed the company to achieve their goals and outcomes much more quickly than earlier fathomed (Butcher, 2018).

A unique method for gaining insights and opinions on drug development programmes was fuelled by social media-based interaction between academia, industry and stakeholders. Patient advocates and stakeholder groups have had the opportunity to exert their opinions and influence on such collaborations, which has led to improved processes, epitomal drug pricing and highly improved patient outcomes (Butcher, 2018).

FIGURE 3 STRATEGIES FOR BUILDING AN IDEAL STAKEHOLDER INTERACTION ENVIRONMENT IN ACADEMIC-INDUSTRY COLLABORATIONS (BUTCHER, 2018).

Figure 3 depicts the new strategies that have been formulated in order to ensure that stakeholder engagement in academic-industry collaborations is as feasible as possible. They are summarised as follows:

- Relationships fostered with stakeholders within the collaboration must always be an open dialogue which works two ways and not a one-way means of communication
- The engagement of stakeholders must be highly collaborative in nature, where all the stakeholders present can contribute their opinions and add their inputs in a meaningful manner
- Industry must be open to abolish a certain segment of control over the collaboration, allowing stakeholders to initiate engagement in the collaboration and shape the outcome of the collaboration
- Industry and academia must be open to discussing all and every issue with the stakeholders involved, no matter how sensitive and serious the matter may be, including drug pricing, patient safety etc (Butcher, 2018).

III. Collaboration Theory:

The Collaboration Theory is built around two models; namely the 'Individual First' and 'Team First' Models. Each of these have three themes which have been used to divide and explain the elements described by each model. It was found that individual and team performance affected intra and inter collaborative conduct consequently, and each manifested as a factor that influenced the success or failure of the other. (Colbry *et al.*, 2014).

These are attributed as follows:

Individual First	Team First
1) Turn-Taking: This Theme stipulates upon acknowledgement of others. It involves listening and being heard. This improved communication, networking and understanding amongst the participants as a result (Colbry *et al.*, 2014).	A. Building Group Cohesiveness: This Theme involves brining in the entire team/teams involved in the collaboration together to overcome daunting tasks which cannot be completed individually, resulting in increased involvement and teamwork. This is rather important, as each individual member of the collaboration has an impact on the success or failure in the collaboration, decreasing the likelihood of this occurring due to the application of this theme (Colbry *et al.*, 2014) .
2) Observing or Doing: This Theme is based on the preference of those involved in collaborations, as to whether they are more observant or highly inclined towards doing and performing. Most of the individuals in a collaboration have either of these approaches, and not	B. Influencing Others: The level of influence exerted within an organization or collaboration can come from anyone, not just the leader or manager at all times. This theory eliminates the idea of information exchange and delegation from top to bottom. This results in increased

both. However, it is found that the former and the latter are essential together to get the best results out of a collaboration (Colbry *et al.*, 2014).	cooperation, exhibiting courage, turn-taking, empathy, teamwork and so many more characteristics, as determined by an experiment with particular groups earlier involved in collaborations and within organizations (Colbry *et al.*, 2014).
3) Status Seeking: This Theme evaluates the reasons for individuals to collaborate, being based on receiving appraisals, being commended for their efforts and for being lauded by other means. Even though individuals are more focused on themselves than on their team, the factor that motivates them to provide their inputs for the team is respect. It is a Theme that is essential for individual and team performance (Colbry *et al.*, 2014).	C. Organizing Work: This Theme focuses on how individuals involved in the collaboration function and perform tasks in the absence of a manager. Some participants involved in the study were able to perform stupendously well in the absence of the manager, while others struggled in understanding the roles and responsibilities delegated to them. There are also participants that were not pleased with the performance of their peers. A system is needed for performing well, in the presence and in the absence of a manager (Colbry *et al.*, 2014).

FIGURE 4 THEMES INVOLVED IN COLLABORATION THEORY (COLBRY *ET AL.*, 2014).

Overcoming the challenge by application of theory:

Inter-organizational collaboration has been related to inter-organizational cooperation and coordination, as the latter two factors necessary for propagating the development of the former. The two have been tied to a number of factors in academic-industry collaborations, namely defined rules, the link maintained between the collaborating parties, resource allocation and the degree of autonomy maintained by each party in the collaboration. The application of Collaboration Theory with other theories determined the link the two factors had with collaboration, and it was found that the greater the level of coordination and cooperation between academia and industry is, the more successful is the collaboration between academia and industry (Hajash, 2018).

Further application of the Collaboration Theory developed by Colbry and Hurwitz has determined the true significance stipulated by intraorganizational collaborations. The drive to achieve results by individuals involved in collaborations that their peers have not achieved manifests as meaningful collaborative output. The culture present in such organizations involved in academic-industry collaborations has a direct influence on intra and subsequent inter-organizational collaboration, confirming the fact that determination and culture play a significant role in influencing the application of the Collaboration Theory in academic-industry collaborations (De Koker, 2019)

The importance of collaboration is not only significant for the collaborating industry and academic institution, but also for all the individuals involved in the collaboration (Sannö *et al.*, 2019).

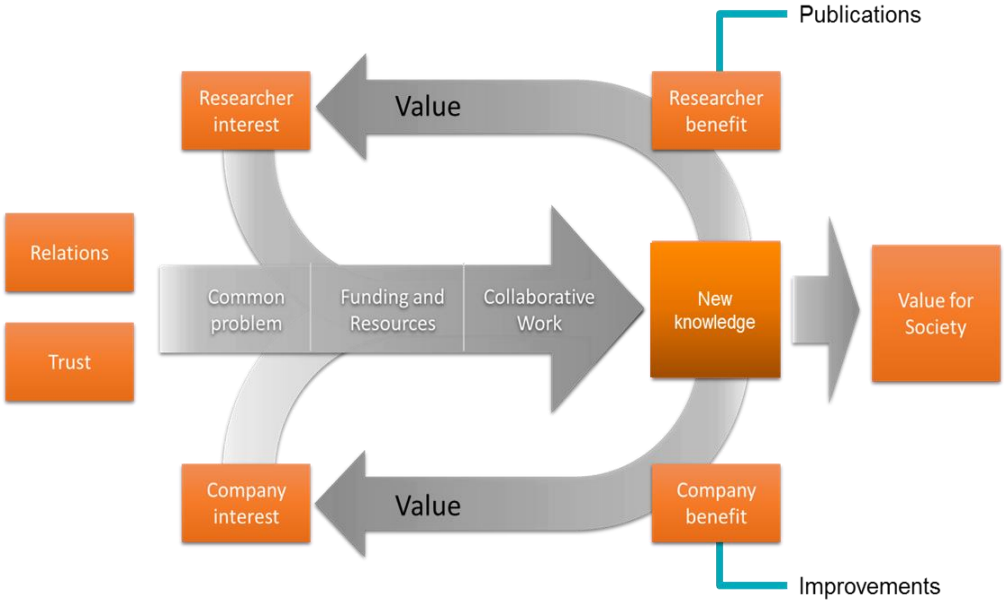

FIGURE 5 THE IMPORTANCE OF COLLABORATIVE-PRODUCTION IN ACADEMIC-INDUSTRY COLLABORATIONS (SANNÖ *ET AL.*, 2019).

The significance of all the individuals involved in the collaboration is made more profound, by spending time and resources in training and educating all the academic and industry professionals involved, in order to motivate them to perform more optimally, also providing them with respect, maintaining good relationships within the organization or academic institution and not just in the collaboration itself (Sannö *et al.*, 2019).

Teamwork is introduced to the system of collaborations when both, academia and industry, have common problems that they cannot overcome solely, such as a lack of resources or scientific expertise. This creates string relations and a strong system of trust amongst the collaborators. This also promotes individual performance, as each individual in the collaboration benefits from the other (Sannö *et al.*, 2019).

IV. Deming's Shewhart Cycle:

The Shewhart Cycle is used for continuous quality improvement and total quality management. It is a tool used widely in healthcare improvement. The Shewhart Cycle uses the Plan-Do-Check-Act (PDCA) approach and is applicable to the quality improvement of collaborations. It was found that using the PDCA approach enabled collaborators to immensely improve processes, collaborative conduct and boost the outcome of the collaboration immensely. (Taylor *et al.*, 2014).

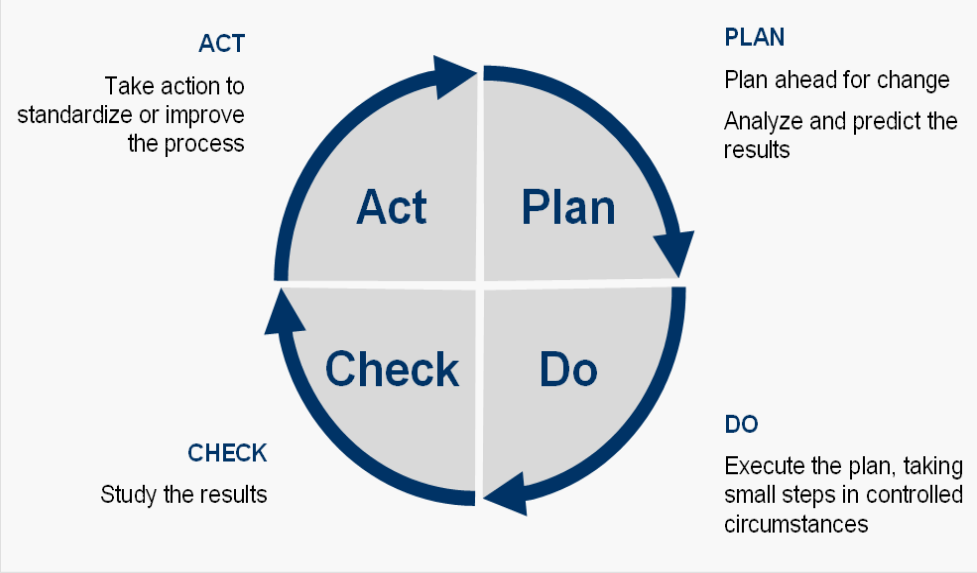

FIGURE 6 THE SHEWHART CYCLE (TANG, 2016).

Overcoming the challenge by application of theory:

The Shewhart Cycle has been extensively used as a tool in aiding in academic-industry collaborations that focus on teaching and consider students to be integral stakeholders of such collaborations. Applying the Plan-Do-Check-Act theme of this theory of collaboration led to improved learning by a large margin, supplementing quality management and stakeholder focus to a high degree (Hasan and Hossain, 2018).

The Shewhart Cycle is extensively used in research and development and is proven to improve the quality of clinical processes and patient outcomes as a result of the bolstered clinical processes. Quality improvement collaboratives that mainly function on the premise of the Shewhart Cycle are immensely effective at improving clinical trial conduct and clinical processes, all while being sustainable and cost-effective to those that have collaborated from academia and industry to form the quality improvement collaboratives (Wells *et al.*, 2018).

A quality improvement method called ‘Quality Improvement Collaboratives’ is used to significantly improve the quality of collaborations. This cycle has been applied in the industry in order to inculcate continuous improvement in individual performance and in collaborations as well. It is extensively used in research and development and is proven to improve the quality of clinical processes and patient outcomes as a result of the bolstered clinical processes (Wells *et al.*, 2018).

V. Social Capital Theory:

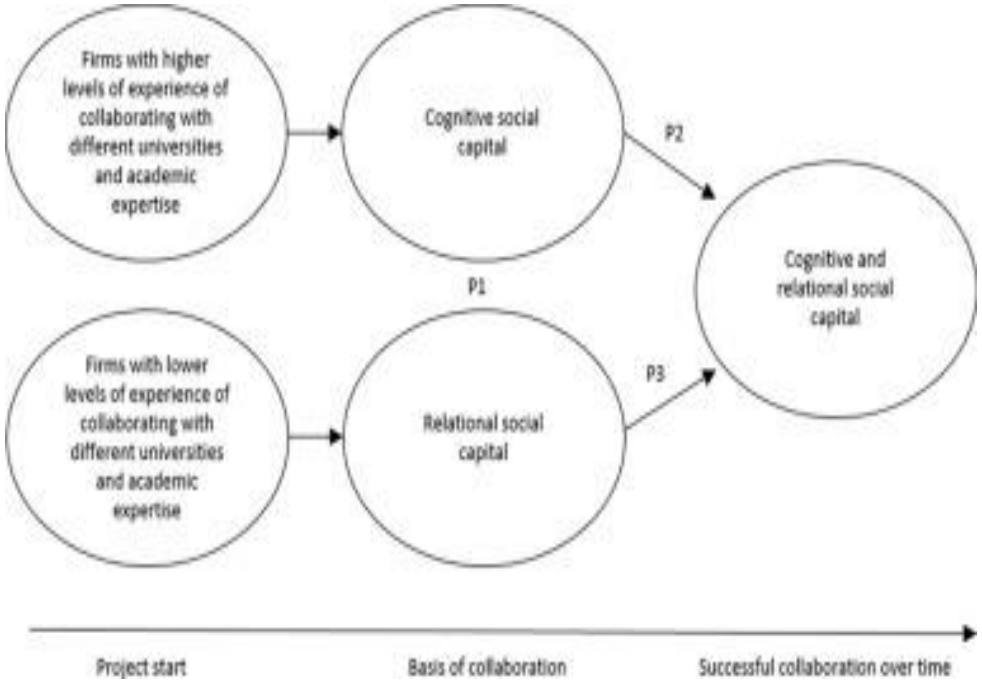

FIGURE 7 APPLICATION OF SOCIAL CAPITAL THEORY TO ACADEMIC-INDUSTRY COLLABORATIONS (STEINMO AND RASMUSSEN, 2018).

Cognitive Social Capital and Relational Social Capital were the themes of the Social Cognitive Theory, which is the common interpretation and shared meanings of codes and systems in a collaboration. The former is composed of influence and trust, while the latter is composed of common culture and common goals. It was found in the findings of this theory, as suggested by Figure 7 above, that using each theme was beneficial for smaller firms, as well as larger firms with more collaborative experience for collaborating, leading to improved outcomes, decreased delays in the project, maintenance of budget and improved relationships between academia and industry. (Steinmo and Rasmussen, 2018).

Overcoming the challenge by applying theory:

The Social Capital Theory is particularly adept at promoting a culture of successful knowledge transference in academic-industry collaborations. In a high-technology industry like the pharmaceutical industry, the Social Capital Theory has wide application in academia to industry knowledge transfer particularly. The transfer of knowledge from academia to industry has highly elevated the rate of commercial research, development, and production. This is as the scientific expertise obtained from academia has promoted those in the industry to utilise the knowledge to its fullest, accelerating learning and alignment within the organization. (Robertson *et al.*, 2019)

Knowledge transfer in academic-industry collaborations is one of the most paramount concepts in achieving a successful output from collaborative efforts. One of the most renowned collaborations which involved knowledge transfer from academia to industry was between Janssen Research and Development and the San Diego Supercomputer Centre (SDSC) at the University of California. It involved the provision of supercomputer analytical technology and knowledge transfer from SDSC to Janssen, which led to drug discovery time being reduced by a timeline of four years in one case. The statistics behind it were stellar. A majority of the analysis of compound elucidation was completed within six weeks, which would have taken four years of continuous output without the capability of the SDSC. (Robinson, 2014)

According to Dr. Pandina, the senior director of Autism Knowledge Engine, knowledge sharing is highly essential for the development of an autism treatment as autism is a disease that can only be diagnosed by expert consultation and continuous observation, as there is yet no methodology for determining clinical outcomes and objectives in clinical trials of autism in patients. Only by obtaining the scientific expertise from academia can there be a pathway to the cure for autism, according to Autism Knowledge Engine. Sharing scientific, strategic and resource-based knowledge is crucial for future drug development (Robinson, 2014).

VI. Core Model Theory:

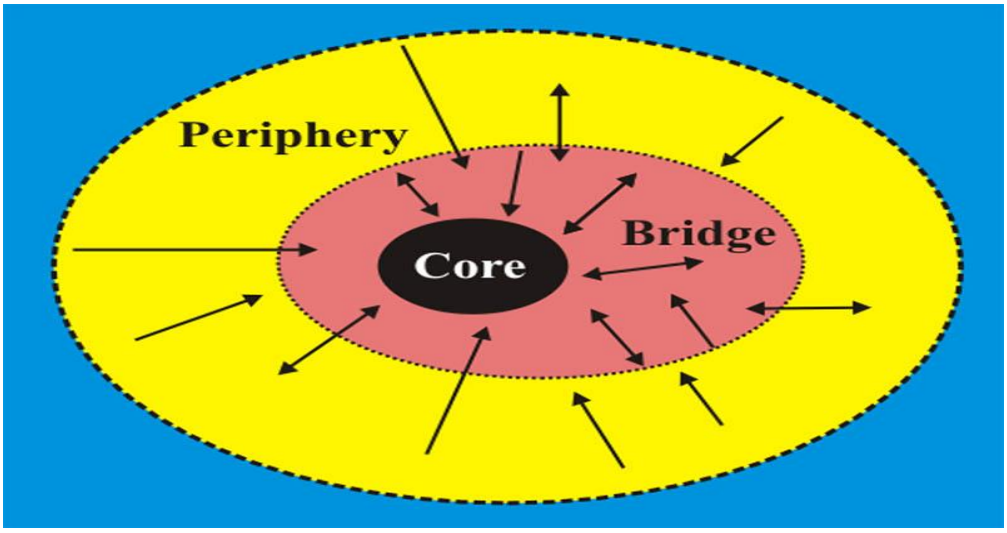

FIGURE 8 DIAGRAMMATICAL REPRESENTATION OF THE CORE MODEL (SANCHEZ- SERRANO, 2019)

The Core Model Theory is divided into three further structures, as represented in Figure 8. Core, bridge and the periphery denoted academia/industry with a goal and reason to collaborate, the collaborator (i.e. academia/industry) that helps core meet its outcome and the stakeholders/government involved, respectively. (Sanchez- Serrano, 2019)

It was found that the bridge enabled the core to reduce time taken, labour employed, provided personnel, alleviated economic pressure and led to bolstered knowledge sharing as a result. The periphery provided grants, resources such as research and development equipment, animal models and reagents, And led to overall improvement in networking between academia and industry. (Sanchez-Serrano, 2019)

Overcoming the challenge by application of theory:

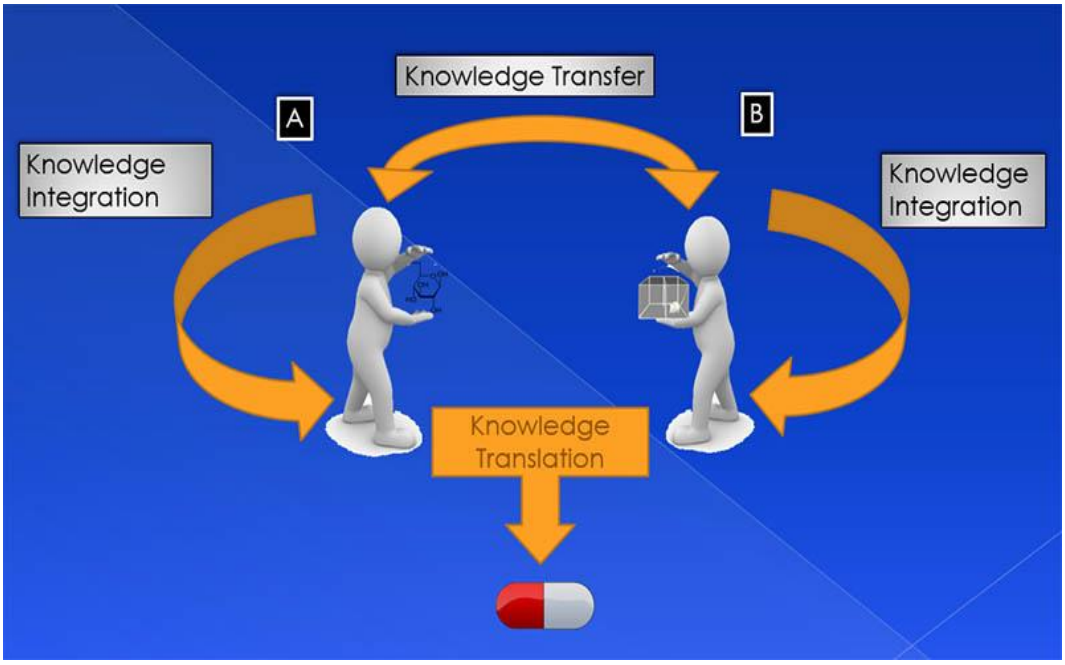

FIGURE 9 A SCHEMATIC REPRESENTATION OF KNOWLEDGE TRANSFER FROM ACADEMIA TO INDUSTRY, INDUSTRY TO ACADEMIA, WHICH IS TRANSLATED INTO MANUFACTURING A SUCCESSFUL COMMERCIAL PRODUCT. (SANCHEZ- SERRANO, 2019)

The Core Model has been widely successful at promoting knowledge transfer within collaborations and instilling a strong culture of networking and relationships in academic-industry collaborations. In the development of cancer drug Bortezomib by the firm ProScript, the Core Model had a huge role to play, as Bortezomib was prone to failing, but thanks to the exchange of assets between academia, industry and the public and private sector, the project was a huge success. (Sanchez- Serrano, 2019)

As described in Figure 10 below, the model helped the drug to become a massive success. The Core was composed of the founders, company personnel and resources needed in the collaboration. (Sanchez- Serrano, 2019)

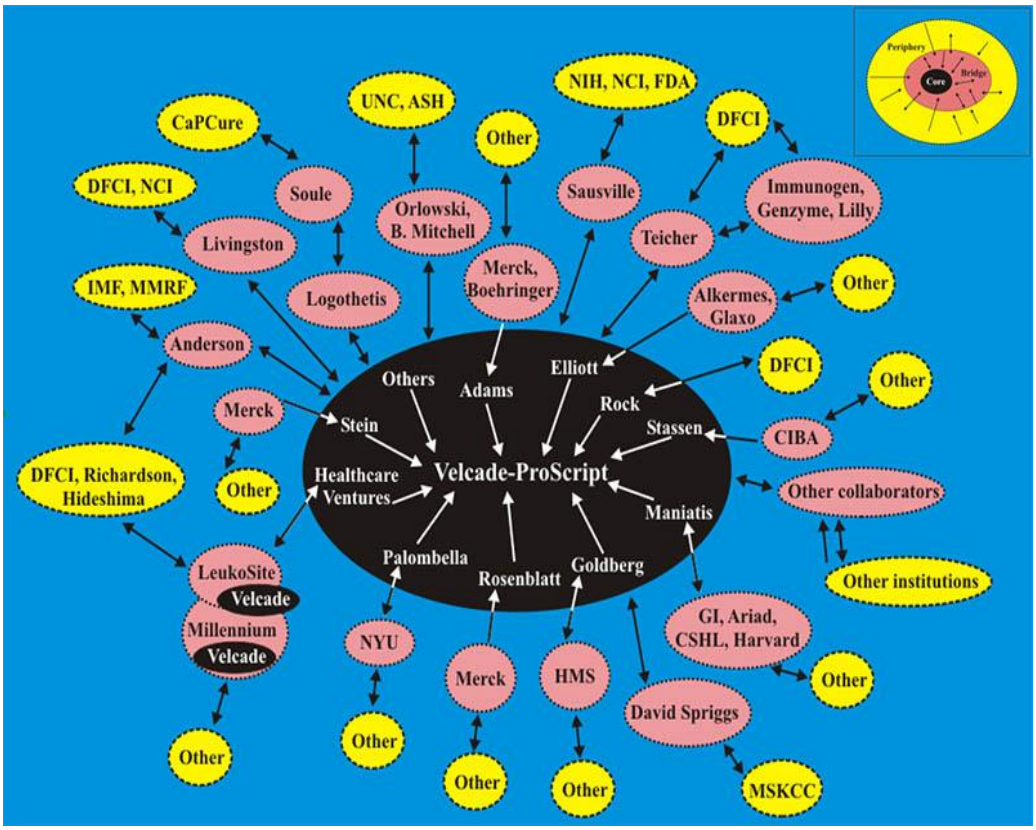

FIGURE 10: APPLYING THE CORE MODEL THEORY TO BORTEZOMIB IN THE ACADEMIC-INDUSTRY COLLABORATION BETWEEN VELCADE AND PROSCRIPT (SANCHEZ- SERRANO, 2019)

In the above figure, the Core forms a collaboration with the Bridge as per the model, composed of academia and scientists that possess a wealth of knowledge in the area of drug discovery, provided animal models for research and validation expertise in proteasome in vivo research that was conducted for Bortezomib. This collaboration led to saving a plethora of time, capital invested in the project and other resources. The Bridge formed an alliance between the core and the Periphery, which opened more avenues for obtaining resources from sponsors and led to robust innovation and created a strong economic framework for all those involved in the collaboration (Sanchez- Serrano, 2019).

2.5 Conceptual Framework:

The type of conceptual framework chosen was determined to be cause and effect. This study approach was chosen as the theories earlier identified in the previous section were able to identify the causes of challenges that hindered academic-industry collaborations, but the study was also able to identify the theories that were applied to overcome the challenges in previously conducted collaborations, producing significantly more optimal results in comparison to when the theories were not applied to collaborations.

The study successfully identified the effect of not conducting these collaborations as per the theories, which included the loss of trust, morale, opportunities for innovation, capital invested and time lost due to not applying the theories identified in the previous section.

The conceptual framework has identified that the presumed causes of the dissertation study focus is that theoretical knowledge gained and penned down by noted writers with a plethora of experience in understanding collaborations has not been utilised by academic-industry collaborations in the pharmaceutical industry in many cases. Due to this, the challenges identified in the previous section become more prevalent, as revealed by the thorough literature review conducted.

The mediating variable in this was found to be a lack of knowledge of theoretical principles and their application was sub-par. This resulted in the effects, manifesting in the form of challenges faced in academic-industry collaborations. However, the moderating variable discovered is supplementary to conducting high output collaborations, as each challenge is viewed openly and a particular application of a theory is implemented, as deemed appropriate to the challenge.

The controlling variables were further identified by deeper exploration of different theories of collaboration. Certain themes were selected, such as trust, stakeholder involvement, teamwork, networking and knowledge sharing. These were identified to be crucial to collaborations in general, as well as in the

pharmaceutical industry. The theories identified and earlier selected are based on these themes, which made their application to academic-industry collaborations more robust and effective, as per the literature reviewed in the previous section.

The confounding variables present were also identified. It included certain theories that were applicable in general collaborations, but not very optimally applicable to those that are conducted in the pharmaceutical industry. Hence, certain theories are more applicable than others is what the confounding variables identified have revealed in this study.

- **Aims and Objectives of the Research:**

- To gain insights on the challenges faced in academic-industrial collaboration in the pharmaceutical industry
- To understand the theories that supplement academic-industry collaborations
- To analyse and determine the degree of applicability of the theories in academic-industry collaborations in the pharmaceutical industry.

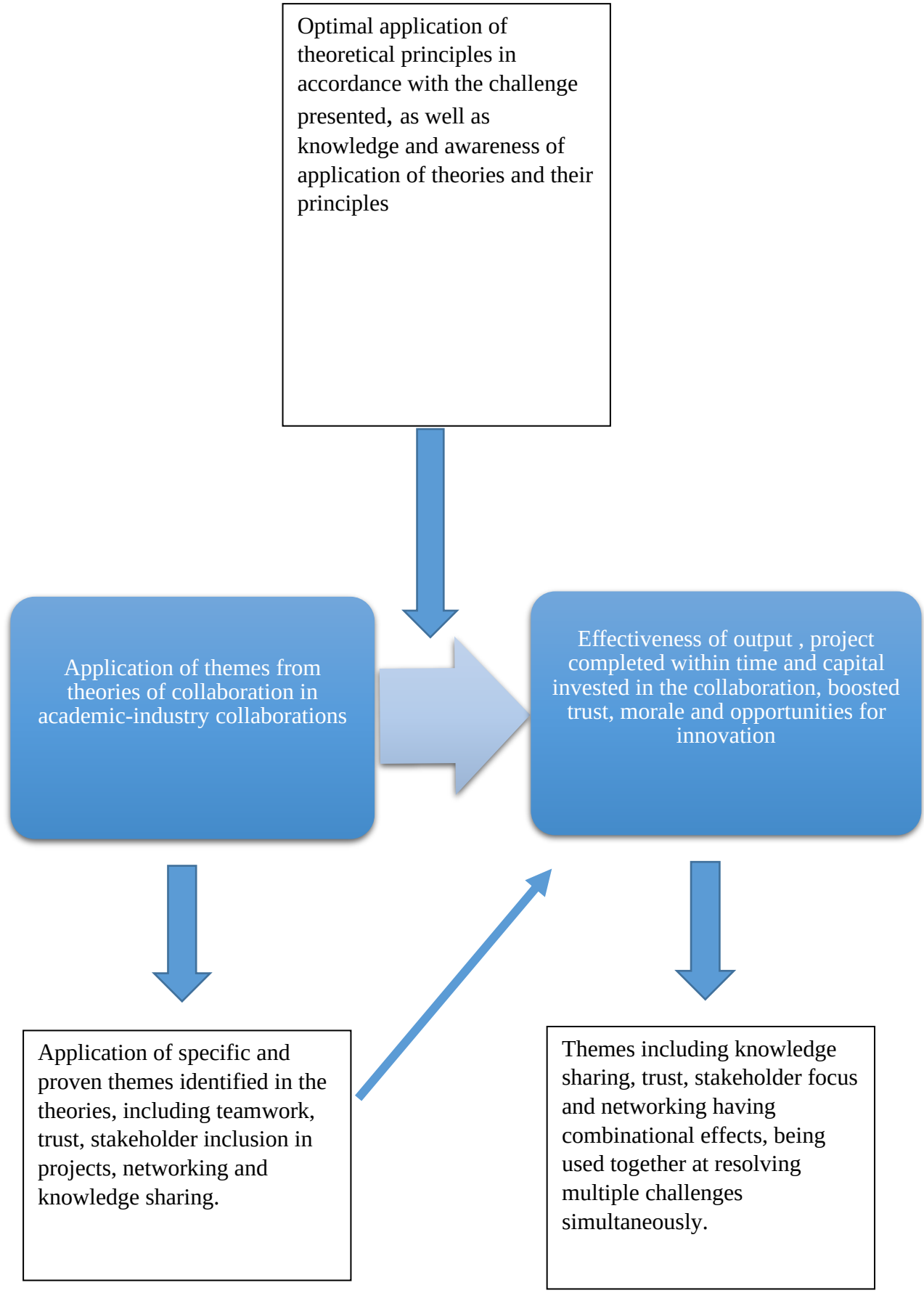

FIGURE 11 CONCEPTUAL FRAMEWORK (LATHAM, 2015A)

2.6 Conclusion:

From the literature review conducted, it is evident that academic-industry collaborations are more complicated than they seem. They are a host of theories that have been explored, and each is unique in terms of how it deals with the challenges presented in academic-industry collaborations. There are a host of challenges and factors that come into play that are difficult to eradicate.

However, determining the best theories of collaboration by seeing the application of the selected theories in collaborations conducted over the past few decades from examples is the best way to move forward, as this provides a framework upon which current and future collaborations can be conducted, resulting in the best possible results being showcased in the form of project outputs within timelines and budget allotted. The literature review has enabled the dissertation to reach the outcome of determining the research objectives rather effectively.

The review of literature has also shown that the impact of academic-industry collaborations in the pharmaceutical industry to be profound, and the problems, challenges and factors that create hurdles in academic-industry collaborations have been determined as well. The best theories that were applicable to most challenges due to the themes that they possessed were highly necessary for overcoming these challenges, as found by me in this study. They were also found due to extensive research conducted by academic and industry professionals, as they shared their journeys and experiences in the articles and research papers explored.

The research questions of this dissertation have been further answered by the aid of conducting further research, in the form primary research.
Reading and understanding the experiences and thoughts of experts involved in these high-level collaborations has shed light on a lot of factors, but conducting in-depth interviews of academic and industry experts on a personal scale has revealed a lot more than just exploring literature, as it provides deeper insights generated on the spot, and hearing not just their experiences, but also their stories

has provided the insights that are necessary for answering the research questions demanded by this dissertation study.

The literature review conducted met all the research objectives and shed light on the most important theoretical principles that would be highly feasible for conducting academic-industry collaborations in the pharmaceutical industry.

It also helped in designing and applying the conceptual framework generated along the course of this study, and enabled me to create a themed diagrammatical representation of the overall study being conducted, its degree of authenticity due to the findings and how these fit in with other variables has provided a system, wherein the research question was further deduced from the preliminary findings, by conducting in-depth interviews with professionals that have decades of experience in conducting such academic-industry collaborations.

Chapter III: Methodology and Research Design:

3.1 Overview:

This chapter explores the methodology and research design of the dissertation study that has been conducted.

The paradigm and philosophical approach was chosen to be Interpretivist, as the nature of the study had involved interpreting the data collected in the primary research by the use of a narrative analysis approach.

The responses of the interviewees selected were taken in the forms of their stories, which was composed of the knowledge and experiences that they had as professionals involved in academic-industry collaborations in the pharmaceutical industry.

The strategy involved was to frame questions for the interview in a manner that enabled me to receive responses in the form of stories of the interviewees that have been interviewed, resulting in the narrative analysis approach being more specific.

The sources of the information were professionals from both, academia and industry, who all have had extensive experience in conducting academic-industry collaborations in the pharmaceutical industry.

The access and ethical issues faced were subliminal, as each of the interviewees were known to me as a result of networking and attending various seminars over the course of years.

The inclusion criteria was that each participant must have had at least a few years of experience in conducting academic-industry collaborations. The exclusion criteria was composed of those participants that did not respond to the interview request and those that did not have experience in conducting academic-industry collaborations in the pharmaceutical industry.

The overall approach to the research methodology and design held coherence, with the combination of the interpretivist approach and the use of a narrative analysis approach, enabling me to conduct a vividly descriptive analysis, revealing a lot about the interconnectivity of themes in theories of collaboration and how they manifested in resolving challenges in academic-industry collaborations in the pharmaceutical industry.

3.2 Research Philosophy and Approach:

Paradigm and Philosophy: Interpretivist

Approach: The paradigm chosen is Interpretivist, due to the fact that data collection and data understanding was not factual, but was perceived as applicable, based on the literature review explored. Therefore, interpreting the data collected was the most feasible option. The data nature is qualitative, as in-depth telephonic interviews have been conducted for the primary research of this dissertation study.

A narrative analysis has been conducted by designing specific questions that allowed me to explore the stories and experiences of the interviewees, which has been interpreted to understand where they made use of specific themes in their experiences, in accordance with the research objectives that were successfully determined by using this approach. The approach has been linked with the conceptual framework designed, and the results were analysed by using a coding system based on the theories applied by the academic and industry professionals in their experience of collaborations.

The paradigm and research philosophy chosen enabled me to perceive the codes generated, categorizing them further based on the conclusion that had been interpreted. The codes were further subjected to more extensive categorization by analysing the degree of similarity some of the codes had with the other codes that were interpreted. This approach provided me with a plethora of codes that were based on the theories of collaboration explored, and this led to significantly substantial conclusions that were drawn as a result, which have been explained and explored further in the next chapter.

3.3 Research Strategy:

The research strategy had involved the determination of the professionals from academia and industry that had extensive experience in conducting collaborations in the pharmaceutical industry. The participants were briefed on the ethics involved, and they participated eagerly, based on the description provided of the dissertation study being conducted. The main research strategy was the design and conduct of semi-structured interviews.

The questions designed were framed on the premise of drawing out the stories and experiences the participants had experienced in their careers, and this provided deeper insights of the elements that were key to the theories earlier explored, and this provided me with significant information regarding the practicality of the theories of collaboration studied in real world application in the pharmaceutical industry.

Participants that had partaken in the study in some cases had experiences of both, academia and industry sides of the collaborations they were a part of, which allowed me to analyse data that contained insights from a wider perspective. This shed light on the capability of some of the theories explored to aid each side of the collaboration in working together and trusting one another, as explored in the literature.

The idea was to get the opinions of academic, industry and the professionals that had experiences on both sides of the collaboration in a manner akin to their personal stories and experiences, generating data that could be analysed by the application of narrative analysis. The strategy was beneficial for obtaining answers with a wider perspective, which provided me with a vast array of data streams coded that was perceived with a wide angle, revealing many concepts and themes that benefited the study over the course of the conduct of this study.

3.4 Collection Primary Data:

3.4.1 Sources:

Participants were enticed by the concept of the research study being explored, as the theories studied had the implications for drawing a conclusion to the challenges presented in academic-industry collaborations. The participants had revealed that they will gain knowledge and awareness regarding the importance and need of collaborations with the perspective of unity.

A short brief describing the dissertation conducted was drafted to allure participants in partaking in the study as it provided insights on what is being done, why it is being done and how will it proceed further. At the epilogue of the dissertation, participants were provided with a summary of the findings.

The in-depth interviews conducted are done for academic and industry professionals. academic researchers, academic chairs and professors have been chosen from the side of academia to be interviewed, all of whom have decades of experience in their field. Four academic professionals have been interviewed, which has provided deep insights on how

academia conducts academic-industry collaborations from their end, and what are their experiences and opinions regarding such collaborations.

Similarly, four industry professionals have also been chosen, keeping in mind their experiences, their knowledge and ability to conduct academic-industry collaborations, and how they feel about the future of conducting the same, paying heed to the theories of collaboration that have been selected in this study.

Four industry professionals have been interviewed, most of whom have decades of experiences at senior managerial and mid-senior level posts in academic-industry collaborations. a majority of industry professionals have been involved in collaborations pertaining to drug development, clinical trials and other projects with academia.

One professional has previous academic experience and has transitioned to the industry as a consultant, and one of the other professionals has decades of experience in the pharmaceutical industry and is now the director of placements and pharmaceutical networking in a leading deemed university. The insights provided by professionals that have has experiences in both sides of the collaboration has provided an extremely well-rounded perspective regarding academic-industry collaborations and what are the best theories that are applicable for conducting the same in the pharmaceutical industry.

Academic professionals were contacted by me, from my previous institution and from having extensive networking due to attending various pharmaceutical and healthcare seminars. Industry professionals were known to me as a result of work in previous companies, as well as networking extensively on professional forums and platforms.

This data has been collected over the months of June and July 2020. It has been analysed by using sophisticated tools such as MAXQDA . The choice of data analysis is by narrative analysis, as this has extensive coherence with in-depth interviews, as it focused on recording stories, memories and perceptions of academic and industrial professionals that were previously and are currently involved in collaborations.

This has provided patterns in the data collected, enabling the dissertation to form a strong base that justifies the literature review conducted. These have provided detailed opinions and answers that fall in line with the research objectives and the research question being explored.

3.4.2 Access and Ethical Issues:

The access issues mainly involved in the course of this dissertation study was to get the particpants to agree to be interviewed, even for a brief period of time. The particpants were contacted via LinkedIn, email and calls. A total of twenty participants were pursued regarding the conduct of the in-depth interviews, out of which eight professionals from both sides responded and agreed to be interviewed. The responses obtained were specific in regard to pertaining to the core of the study's objectives and conceptual framework.

The experience of approaching people, negotiating and convincing them to be a part of the study was quite challenging at first, but very enlightening over the course of the primary research that was conducted. The idea of approaching people was to ensure that the theme of the study is applied to the interviews as well, which included the proposition for each participant to collaborate with me for understanding the key themes and concepts explored in collaborations that are necessary for overcoming the challenges earlier identified.

The above approach taught me more about how it is to not just learn about collaborations or explore literature on the same, but collaborate with the interviewees themselves in the quest to establish the key themes identified, including trust, knowledge-sharing, networking and stakeholder involvement in collaborations for the best results obtainable.

There were minor ethical issues, regarding the identity of the interviewees to be kept confidential in some cases in the dissertation study conducted. Besides this, there were no other complications in the conduct of the primary research, and the participants were highly eager and willing to provide their insights on the questions proposed in the in-depth interviews conducted, which has provided a solid foundation upon which the analysis was conducted quite clearly, in line with the literature review, research objectives and the conceptual framework designed.

3.5 Approach to Data Analysis:

The data analysis approach included producing a coding system based on the theories of collaboration explored in the literature review. Transcripts from the interview were generated from each participant, and the codes produced for each theory were matched with the responses provided by the participants.

This approach led to understanding the application of the chosen theories to the experiences of the academic and industry professionals with collaborative experience and revealed the utilisation of said theories in specific circumstances in academic-industry collaborations.

MAXQDA was applied as an analysis tool, using its transcription mode to transcribe the recordings of the interviews and were coded using the same. All the findings coded produced a pattern of the different uses of theories under a variety of circumstances in the collaborations coded and analysed by using a narrative analysis approach.

A creative coding function was used visualise the coded system produced, and then proceeded to further analyse the generated patterns by using MAXQDA's code relations browser, which presented a vivid diagram of individual and overlapping codes in from the primary research analysis conducted.

explores the techniques used in data analysis. MAXQDA was the tool of choice in this dissertation study, as it has been used for narrative analysis extensively earlier by other individuals, and has dedicated analysis and coding tools that allowed me to deeply analyse the codes, the relation each code has with the other, which allowed me to draw strong conclusions in this dissertation study.

Otter.ai was the tool used to record and transcribe the interviews conducted. Following this, the codes generated were applied to the transcripts, which revealed the applicability of the theories of collaboration to the collaborations that have been conducted and questioned about earlier from the interviewees.

The narrative analysis was conducted by organising the codes in line with the stories and experiences of the interviewees, and tools in MAXQDA including Creative Coding and Code Relations Browser, which explained the relationships between codes and subcodes,

and showed the importance of the presence of multiple themes in academic-industry collaborations respectively.

The Codes Matrix Browser was another visual tool of MAXQDA that was used. This tool analysed the codes generated, and it created a chart that showed which of the themes that were coded held the greatest significance and relevance to academic-industry collaborations in the pharmaceutical industry.

A near codes function was used to assess the specific relativity of one code with another, which included the codes that were fairly similar to one another. The overlapping codes produced credible conclusions that revealed which codes were most utilisable and led to the formation of new themes in the data that was analysed.

3.6 Inclusion and Exclusion Criteria:

The participants in this Study are academic and industry professionals, particularly those that have been involved in academic-industry collaborations. All the participants that were interviewed were considered in the inclusion criteria. The participants that were approached for being interviewed and did not respond to be interviewed on time were automatically added to the exclusion criteria.

Other than this, no other exclusion criteria has been established in this study. Each participant that has been interviewed in this study was given a brief description of the study, provided information regarding informed consent and were given prior discretion regarding whether they would like to share their identity and designation, and whether they would like to be included in the list of Acknowledgements or not. Out of all the interviewed participants, one professional chose not to be identified in this study and preferred to be remain anonymous.

3.7 Conclusion:

Academic and Industry professionals that took part provided a deep explanation of their experiences, based on a particular format of questions designed by me. The data generated was matched, further analysed and the findings were determined as a result of the same. They are provided in the proceeding chapter.

The overall methodology and research design have been approached with an interpretivist approach, which has allowed me to perceive the responses and the data subsequently analysed as both, relevant and irrelevant under certain circumstances, such as a certain theory being applicable to only or more challenge presented in the collaboration, while some are quite widely applicable and had hidden themes for resolving even more challenges that were not comprehended earlier, as explained in the following chapter.

The participants chosen for this study have provided extensively relevant insights and inputs, and there were minimalistic access and ethical issues in pursuing the same. The data analysis approach to this study was quite simplistic yet was able to unravel the principles employed in resolving complicated challenges with a unique perspective. The interpretivist approach was most useful in determining the best theories of collaboration, and how applicable they were at conducting seamless collaborations.

The methodology used in this study provided highly relevant themes as a result of the narrative analysis approach to data analysis being chosen as the choice of approach. This gave me a degree of hindsight after conducting the analysis, which made the drawing of conclusions and findings all the more feasible and appropriate.

The analysis approach has been further explained in the following chapter of this dissertation study.

Chapter IV: Presentation and discussion of findings:

4.1 Overview:

The previous chapter discussed the research methodology, research and analysis approach, and the conclusions drawn by selection of the research philosophy and paradigm.

This chapter includes a detailed explanation of the choice of analysis chosen for this dissertation study, and what were the key findings that were determined by using the interpretivist approach, which included the design of specific codes that were relevant with the literature review and primary research conducted.

Based on the theories of collaboration explored in the literature review, specific codes based on the themes present in the theories were produced. This included trust, networking, knowledge sharing, challenges presented and overcome by the using the themes, as well as common goals, total quality management, and stakeholder focus.

The selection and utilisation of these codes helped me in determining the application of the themes in the theories of collaboration in real world application, as the interviews of the participants were transcribed, coded and the codes generated were compared to see which had the greatest applicability in particular situations.

The analysis generated in this chapter is based on the analysis approach method described in the previous chapter. The analysis approach allowed me to select the themes generated from the primary research conducted in line with the literature review explored, and to use those themes at creatively overcoming challenges by using specific analytical tools, as explored in this chapter.

The next section in this chapter has listed the findings drawn from the narrative analysis conducted, with evidence supporting it in the form of visual analytical representations.

‘

4.2 Findings and evidence:

i. Every theme in different theories of collaboration is connected and related, in terms of specific applicability in dealing with the listed challenges

The themes used in the theories were used as codes for application to the transcripts generated from the interviews conducted for the particpants in the dissertation study. As suggested by the Figure 12 (Code Map of Relations) below as well as in Appendix M, each code is interrelated with the other. The collaboration assessed were between academia and industry, but some theories also denoted that collaborations within the organization as well were of significant importance.

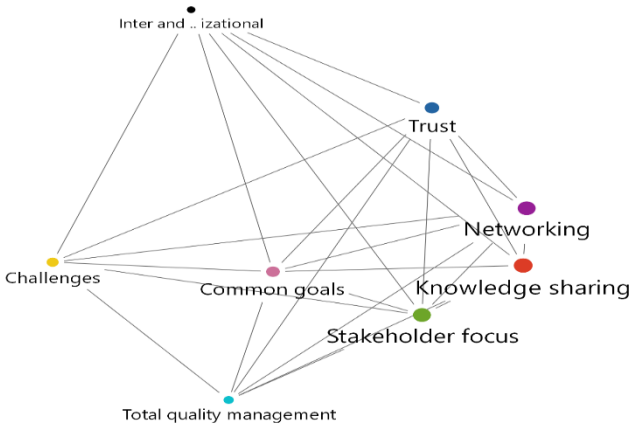

FIGURE 12 CODE MAP OF RELATIONS

Hence, a code of inter and intra organizational collaborations was created and assessed accordingly in the primary research. This code was found to be encompassing all the other determined codes, such as networking, knowledge sharing and common goals, which were all subcodes of trust, the main factor found to facilitate all three.

Evidence:

Figure 12 in Appendix M was produced as a result of the creative coding and analysis tool of MAXQDA. It displays the relations that each identified theme from the theories of collaboration have with the challenges, with each other in overcoming the same, and how they supplement the solutions identified to further overcome the challenges presented, including stakeholder focus and total quality management.

The codes for each theme were created, compared and pooled together to assess the significance each hold individually and together, in order to give the research analysis a key finding and a plausible conclusion.

Figure 12 displays the relation of each code with the other, signifying the magnitude of similar significance in relation with the numbers of lines. The greater the number of lines that connect each code, the greater is the connection they have.

For instance, the inter and interorganizational collaborations conducted all have relations with the themes found in the theories of collaboration. Trust was found to be related to every other theme, as it has an impact on overcoming the challenges presented, influencing networking, common goals and knowledge sharing as well.

Common goals was found to be the most connected theme, as only through common goals were collaborators able to apply the remainder of the themes identified. Without academia and industry having common goals, the collaboration was not complete within time, was not successful, the budget set was exceeded in a majority of cases as found by the primary research.

Not only that, but by having common goals between academia and industry, the other themes, including trust, was established far more significantly. Hence, common goals was highly connected with other themes, as displayed by Figure 12.

Common goals have also been utilised to overcome challenges presented in academic-industry collaborations as well. This is as common goals have allowed the collaborators to include stakeholders in the decision-making process, as well as work towards the common goal of high stakeholder focus.

Total quality management is a tool that is highly utilised in clinical trials in academic-industry collaborations. This tool was also found to be used extensively, as revealed

by the primary research conducted with the academic-industry professionals. The sample transcript in Appendix C further supplement this claim with evidence, as the professional from industry interviewed spoke about how using elements of planning, doing, checking and then acting aids in maintaining quality in collaborations.

Out of all the themes explored, trust is connected to every other theme and has a direct impact on the challenges presented by supplementing the idea of having common goals, based on the trust that has been established between academia and industry.

Discussion:

The finding identified holds coherence with the literature review conducted and the research objectives previously established.

The research objectives established and the literature review conducted focused on identifying the challenges in academic-industry collaborations in the pharmaceutical industry, the theories of collaboration necessary for conducting general academic-industry collaborations, and how these theories can be applied to the academic-industry collaborations pertaining to the pharmaceutical industry.

The connection found between themes in different theories of collaboration applied in this dissertation study has identified the most prominent challenges that are faced in academic-industry collaborations in the pharmaceutical industry. The challenges were linked to many other themes, including networking, trust, knowledge sharing, total quality management, and stakeholder focus.

This link allowed me to understand the most recurring challenges faced in academic-industry collaborations in the pharmaceutical industry, the themes linked to these challenges that have been proven to resolve and overcome the stated challenges, and how these challenges are prevented from resurfacing in future collaborations in the pharmaceutical industry.

The theories explored based on conducting academic-industry collaborations were applied fairly well in this analysis and interrelated rather meticulously.

Theories including Huxham's Theory of Theorizing Collaboration, Deming's Shewhart Cycle Theory, Stakeholder Collaboration Theory, Core Model Theory and

the Collaboration Theory are all renowned and proven theories in conducting academic-industry collaborations, as identified in the literature review conducted.

Their application in the dissertation study conducted justified the literature review conducted and met the research objectives set, as the themes generated from these theories became the codes for analysing the primary research conducted.

Themes were taken from Huxham's theory, including trust and common goals, the main theme of Inter and Intraorganizational relations was taken from the Collaboration Theory, which was used to assess the themes further produced from the remainder of theories. The theme of stakeholder focus was taken from the Stakeholder Collaboration Theory.

The theme of networking and knowledge sharing were inspired from the Core Model Theory and total quality management as a theme was taken from Deming's Shewhart Cycle Theory.

The theories explored were particularly relevant to the research objectives, as the theories were specifically for collaborations. This allowed me to apply the themes consequently to the primary research conducted, and made the themes generated more applicable and relevant by comparing them to the collaborations that have been undertaken in the pharmaceutical industry.

The relationships between the plethora of themes generated further allowed me to understand how each theory of collaboration explored was related to the other, and how can the combination of themes from theories generated be used to resolve the identified challenges in academic-industry collaborations in the pharmaceutical industry.

The examples of academic-industry collaborations in the pharmaceutical industry that utilise these themes from the theories of collaboration was a key objective and key element of the literature review. This is as this has helped me in establishing the application of these themes to real world academic-industry collaborations in the pharmaceutical industry.

The gap identified in the primary research and analysis conducted was that the themes used and applied were common with what I have done and what previous authors of the explored literature have done as well, but what I have done in this dissertation

study is identify theories of collaboration with multiple themes that can be applied to resolve even more challenges than before.

The relations found in the analysis between the different themes explored in Figure 12 guided me in confirming the findings and justify the research objective and the literature review conducted.

The connectivity between the themes proves that the theories of collaboration with one or more theme are all related in small ways, and each element identified helps in overcoming the stated and explored challenges with promising solutions and focus.

The finding of how interrelated the themes are and how they justify the research objectives and literature review have been confirmed by using the MAXQDA Code Map of Relations, which extensively analysed the degree of relation each theme has with the other.

ii. Knowledge sharing, networking and stakeholder focus are more prevalent and applicable than their corresponding counterparts at resolving specific challenges in academic-industry collaborations.

The codes generated were compared after generating their relations map via creative coding. According to Figure 13 below as well as in Appendix M, some of the codes had far more applicability and prevalence than the other codes generated from the themes in the theories of collaboration.

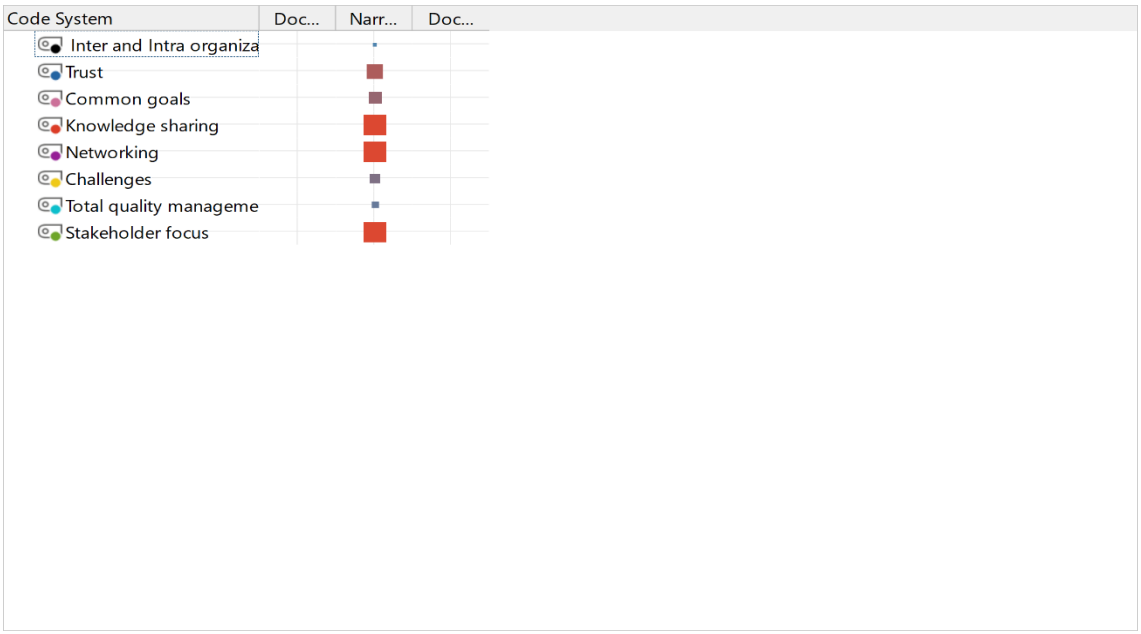

FIGURE 13 MAXQDA CODE PREVALENCE DISTRIBUTION

Figure 13 proves that themes such as stakeholder focus, networking and knowledge sharing hold higher importance in conducting academic-industry collaborations in the pharmaceutical industry. The combination of themes will be explored in the following section of evidence found.

Evidence:

As showcased by Figure 13 in Appendix M, the prevalence and significance of the three codes of stakeholder focus, networking and knowledge sharing have a higher focus than the remainder of the codes. However, this does not undermine their importance in any case.

The codes generated are based on the themes in the theories of collaboration that have been coded on the basis of the responses of the participants in the in-depth interviews. Inter and intra organizational collaborations are based on the collaborative practices within the industry and with academia. Most of the interviewees that submitted their responses believed that these themes are important but chose to prefer other themes in comparison to this, as depicted in Figure 13.

Knowledge sharing was the theme, which was preferred maximally by industry professionals interviewed, in comparison to academia professionals, who believe that networking is far more important in comparison. The justification for the same is displayed in Appendix C.

Industry professionals believe that without knowledge sharing, academia and industry cannot collaborate effectively enough as academia possesses more knowledge of technology and research, whereas academia professionals interviewed believe that networking is the epitomal theme in academic-industry collaborations in the pharmaceutical industry, as academia needs to network with industry extensively in order to get more projects and communicate more effectively in on-going projects.

As depicted by Figure 13 in Appendix M and the transcript in Appendix C, academia and industry professionals may be more inclined towards focusing on networking and knowledge sharing, there are some particular challenges that required other approaches to overcome, which involved deploying and applying themes from the other theories of collaboration specified.
Total Quality Management and stakeholder focus were the most extensively utilised themes in terms of overcoming challenges pertaining to quality and common goals, respectively. Total Quality Management was a theme utilised as a tool mainly in dealing with challenges that pertained to clinical trials, preclinical studies, animal models, as found in the primary research conducted.

However, this theory was also used extensively in the process of purchasing and technology transfer processes of analytical instruments in academic-industry collaborations, as depicted by the interviewee in the transcript in Appendix C.

One of the participants, an industry professional with decades of experience in conducting clinical trials, stated that total quality management principles included in the Shewhart Cycle were incredibly useful in recruiting volunteers in clinical trials, as well as design detailed clinical protocols, which were helpful to physicians and clinicians involved in the quality improvement collaboratives within the academic-industry collaboration.

According to the transcript in Appendix C, the theme that is the most difficult to achieve is trust. Trust is a theme that is an integral part of most of the theories of collaboration that have been explored in the literature review, including stakeholder collaboration theory, Huxham's Theory of Theorizing Collaboration and Collaboration Theory.

As depicted by Figure 13 in Appendix M, the challenges presented in academic-industry collaborations in the pharmaceutical industry are not majorly significant, as long as the themes found from the theories of collaboration are applied effectively in circumstances accordingly. According to the transcript in Appendix C, extensive experience and a keen eye is necessary for identifying challenges and applying these themes to overcome challenges effectively.

Discussion:

The primary research conducted, and the conclusions drawn consequently from the analysis conducted hold coherence with the research objectives earlier set and the literature review conducted.

The challenges identified in the literature review were akin to those identified in the interviews conducted with academic and industry professionals that have or are involved in collaborations between the two in the pharmaceutical industry.

The challenges explored were mainly related to a lack of networking, knowledge sharing and a deficit of common goals between academia and industry in academic-industry collaborations in the pharmaceutical industry.

The finding explored clearly adds emphasis on the importance of networking, knowledge sharing and the new key emerging theme that indirectly led academia and industry to have common goals which was found to be stakeholder focus, according to the transcript generated in Appendix C.

The theories of collaboration explored gave rise to impeccably applicable themes that are extensively applicable to resolving challenges in academic-industry collaborations in the pharmaceutical industry, as proven by the literature review and the primary research conducted.

The research objectives were to explore the theories of collaboration and to understand how they can be applied to academic-industry collaborations in the pharmaceutical industry. The finding supplements the determination and fruition of the research objective set, as themes of applicability have been identified for the same, as depicted in Figure 13 in Appendix M.

According to Figure 13 in Appendix M, the themes identified and applied to the interviews conducted in the primary research all have highly specific yet wide ranging applications in resolving challenges in academic-industry collaborations in the pharmaceutical industry.

iii. Combinational themes generated better outcomes than individual themes:

An analysis of the codes used was generated and the codes were compared to understand their utilisation and need, as per the in-depth interviews conducted. Figure 14 below as well as in Appendix N depicts the combination of codes at different instances in the collaborations conducted by academic and industry professionals that have been interviewed in this dissertation study.

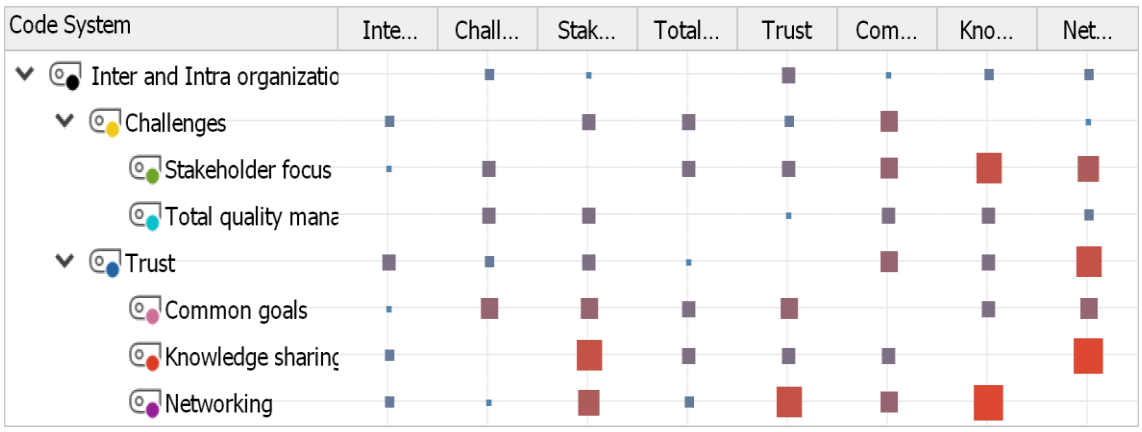

FIGURE 14 CODE RELATIONS ANALYSIS

The codes analysed drew the final conclusion for this dissertation study. The combination of themes from different theories of collaboration have brought great results for collaborators on both sides of the collaboration, which is further explored in the following section of evidence.

Evidence:

As showcased in Appendix C of the transcripts, it was found that one of the particpants in the dissertation study possessed experiences of both, academia and industry. As explained by the transcript in Appendix C, the combination of trust with networking and common goals allowed the professionals to achieve monumental outputs in the collaborations, within the allotted timelines.

One of the professionals is the director of pharmaceutical networks of a leading pharmaceutical university in India. His experiences in the industry and the trust established with his peers allowed him to foster strong networks and have common goals with industry, which led to increased interaction of industry professionals with students in the university led by him.

Another instance where the combination of multiple themes was beneficial in academic-industry collaborations in the pharmaceutical industry was when the university had an MoU with a renowned hospital in Mumbai. The students were sent to the hospital in order to gain knowledge on pharmacovigilance practices.

Not only did they indulge in knowledge sharing, but they were also guided in providing any observed adverse drug reactions in patients. This led to increased job avenues for the students, inculcating the themes of knowledge sharing, networking and stakeholder focus. Increased stakeholder focus was observed when the collaboration between the university and the hospital resulted in increased detection of adverse drug reactions in patients.

Another example that proved the application of multiple themes from different theories of collaboration to be fruitful was when the university networked extensively

with GSK India, hosting senior industry professionals to deliver lectures to students inn regulatory affairs.

The most ardent students were selected on merit in GSK. This resulted from increased networking and common goals between academia and industry, as well as knowledge sharing between industry professionals and students.

Figure 14 in Appendix N also depicts the strong connection between trust and networking in these collaborations in the pharmaceutical industry. One of the two professionals interviewed that had experiences in both academia and industry provided strong insights on the importance of the combination between these two themes.

The professional was involved in academia as a senior researcher in academic-industry collaborations, who then moved to the industry side of collaborations as a consultant. As shown in Appendix C, the professional explained that due to having strong networking and trust with his past associates, he was able to arrange the project's key components within the time allotted for the collaboration.

Trust is complicated in directly collaborating due to it manifesting in the form of intellectual property and memorandums of understanding, which is needed in initial collaborations between academia and industry. However, when trust is achieved over time and is established, it can be increased even greatly between the two collaborators when applied in combination with other themes, including networking and common goals, as depicted by Figure 14.

The Shewhart Cycle approach not only bolstered the collaborative conduct, but also led to improved empirical treatment outcomes by 20-30 percent, resulting in boosting stakeholder focus simultaneously with a single approach.

Inter and intraorganizational collaboration themes have not shown to be supplementary with any other theme identified as much as they have been with trust, as shown in Figure 14. The professional from industry interviewed explained that due to the hosting of exchange programs between industry, academia and contract

research organizations, there was increased trust and transparency observed between the three parties involved.

The application of trust with the organizational collaboration themes also led to increased knowledge sharing and networking. The themes, when combined, led to the application of even more themes in academic-industry collaborations in the pharmaceutical industry, as depicted in Appendix C and Appendix N.

The exchange programs also led to each of the professionals from academia and industry to work closely together, exchange knowledge at all levels, and overcoming challenges at all fronts of academic-industry collaborations in the pharmaceutical industry.

Discussion:

The combination of themes that have been observed in this finding supplement the research objectives and holds coherence in accordance with the literature review conducted in this dissertation study.

As depicted in the transcript in Appendix C and Figure 14 in Appendix N, the combination of themes from different theories of collaboration are more effective at overcoming challenges in comparison to individual themes from single theories of collaboration, producing more robust academic-industry collaborations in the pharmaceutical industry.

Figure 14 has drawn conclusions from the combination of codes used, and the results obtained concluded that challenges in academic-industry collaborations in the pharmaceutical industry are overcome by individual themes in certain cases without the need for combining themes, including stakeholder focus, common goals and total quality management.

However, these themes are supported by other themes in most circumstances, so combining themes is found to be a better alternative in most cases. The best theories of collaboration have been determined for conducting academic-industry

collaborations as a result of this finding, which supports the literature review and the research objectives established.

The selected theories of collaboration have provided me with the most suitable themes and the most suitable combinations to overcome specific challenges, as these have been found to supplement academic-industry collaborations, in the literature review conducted as well as in the primary research explored in the form of in-depth interviews that have been conducted for academic and industry professionals that have been involved in collaborations previously and currently.

The application of these theories and their themes in combination in the academic-industry collaborations in the pharmaceutical industry have been proven to be apt at resolving challenges, including completion of projects in the collaborations within time and budget.

Not only were the collaborations successful in terms of figures, but the combinational theme-based approach was also adept at boosting morale, motivation and knowledge exchange in academic and industry professionals involved in academic-industry collaborations in the pharmaceutical industry, as explored in the literature review.

Based on the in-depth interviews conducted, industry and academia professionals strongly believe that the themes explored need to be inculcated in the conduct of academic-industry collaborations, as this permits a win-win situation for all those involved in the collaboration, as well as the stakeholders for whom the collaborations are being conducted for.

Figure 12 not only showed the relations between different themes but showed how often the themes have been used together in the same situations for resolving the same challenges. This has provided me with a conclusive finding regarding the importance of approaching academic-industry collaborations with multiple themes derived from multiple theories in mind simultaneously.

4.3 Overall Discussion:

The findings that have been established and described have fulfilled the criterion of the research objectives that had been established at the beginning of the dissertation study.

The challenges that had been discovered and explored in the literature review as per the research objective set described how academic-industry collaborations in the pharmaceutical industry face hurdles due to a lack of incorporating certain practices and themes as discovered in the second research objective set.

The analysis conducted showed that academic and industry professionals shared similar challenges and hurdles that were prevalent in the academic-industry collaborations that they have been a part of. The analysis and the subsequent findings confirmed that the challenges earlier explored in the literature review were similar to those experienced by the professionals that have been interviewed.

The second research objective that had been established was to discover the different theories of collaboration that have earlier been applied to academic-industry collaborations. The theories explored provided relevant themes and principles that had been used previously to overcome the challenges faced in academic-industry collaborations.

The findings concluded that the theories of collaboration chosen and explored had monumental applications in academic-industry collaborations, as the themes generated from these theories of collaboration were used as codes to understand the applications of said theories in the experiences of the industry and academia professionals interviewed using a narrative analysis approach, academic-industry collaborations, as per Figure 15 given below, which describes the summary of the responses provided by the participants per code generated.

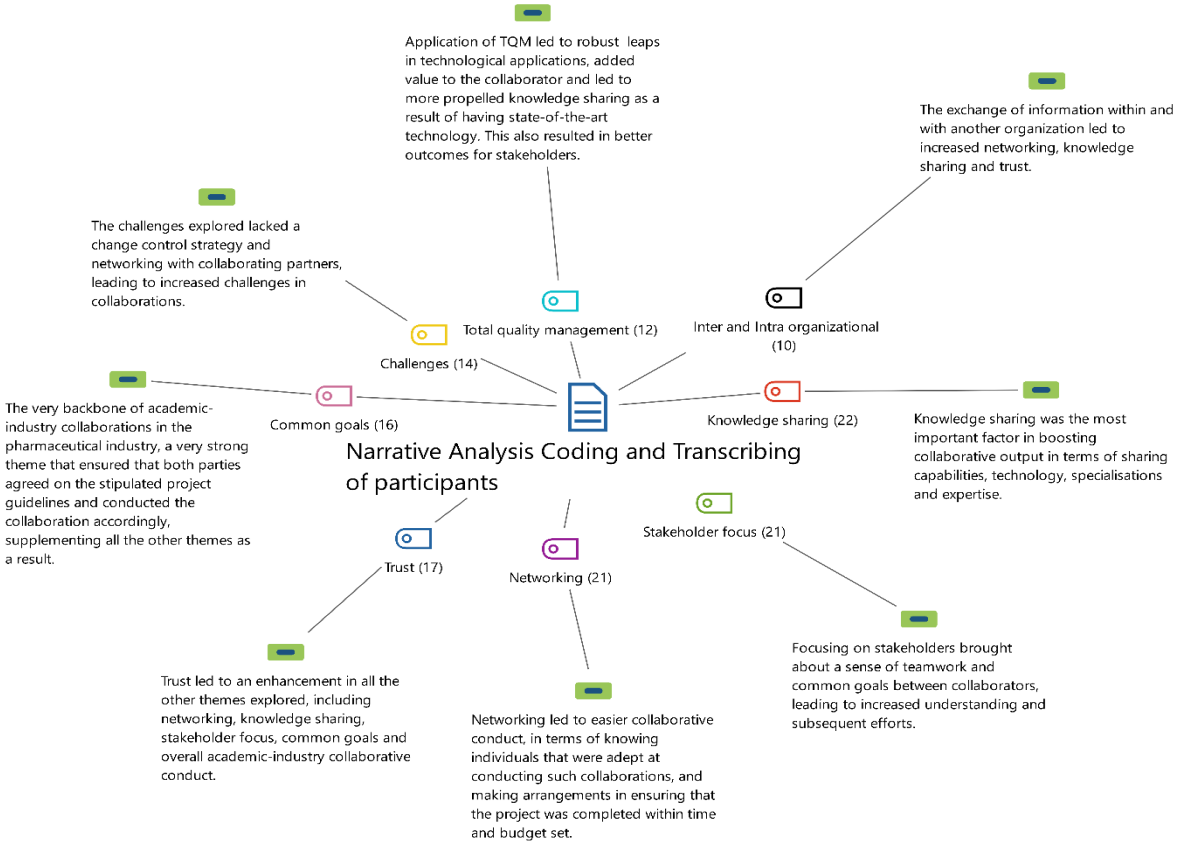

FIGURE 15 NARRATIVE ANALYSIS OF CODES GENERATED

The final research objective was to understand how these theories of collaboration can be applied to supplement academic-industry collaborations, specifically in the pharmaceutical industry.

The findings concluded that the themes generated from the codes highly supplemented these collaborations in the pharmaceutical industry, as explained by Figure 15 in Appendix N. This was designed as a result of conducting a narrative analysis for each participant from academia and industry, and their overall stories were coded and summarised to conclude what each code signifies.

This allowed me to analyse results seamlessly, as it proved that the research objectives set were in coherence with the literature review explored, the primary research conducted, and the conceptual framework designed to get acceptable results in line with the same.

Figure 15 describes how each theme studied supplements the other in a visual representation of the findings. The themes were all found to be interrelated, and the

magnitude of their application individually as well as in combination was found to supplement the application of the theories of collaboration in academic-industry collaborations in the pharmaceutical industry.

4.4 Conclusion:

The analysis conducted based on the findings from the primary research have concluded that the application of theoretical aspects from theories of collaboration have had a positive impact on the conduct of academic-industry collaborations in the pharmaceutical industry, as proved in the literature review and the primary research conducted with academia and industry professionals.

The connections found between the different themes from the theories of collaboration explored have helped me in establishing the fact that one theory is not sufficient at dealing with the array of challenges presented in these collaborations. The importance of combining themes such as trust, networking, knowledge sharing, common goals and total quality management is profound, and helps in resolving challenges earlier deemed too complex to eradicate.

A certain number of themes, such as stakeholder focus, networking, knowledge sharing and common goals were found to harbour more potential than the remainder of themes at dealing with more challenges simultaneously, as depicted in Appendix C and D. These themes held hidden potential for being applied to situations where collaborators, despite having the technical and managerial expertise, failed to collaborate due to a difference in common goals and clear communication.

The most profound finding was the application of themes as combinations to deal with the most complex challenges found in academic-industry collaborations in the pharmaceutical industry.

The amalgamation of networking with knowledge sharing led to bolstered collaborative outputs, the combination of stakeholder focus with total quality management led to extensively improved clinical outcomes and empirical outcomes for patients, and the simultaneous inclusion of common goals with trust ensured that inter and intraorganizational collaborative efforts were optimised for maximal efficacy.

The overall findings have brought to light the profound implications given by the theories of collaboration regarding the incorporation of its themes and principles in real time collaborative conduct in the pharmaceutical industry, and how these can be manifested in the form of fruitful and long-lasting collaborations, those that sustain strong levels of trust, networking and provides solutions for its stakeholders.

Chapter V: Concluding Thoughts on the Contribution of this Research, its Limitations and Suggestions for Further Research

5.1 Implications of Findings for the Research Question:

The findings from this dissertation study are quite applicable for usage in academic-industry collaborations, both in theory and practice. The theories of collaboration explored have been derived from theory, and their application in the pharmaceutical industry has also been explored in the literature review. Their complete application was determined by the primary research conducted, and subsequent findings were established as a result of the analysis conducted.

The theories of collaboration, their themes and the combination of themes as an application explored have implications for overcoming challenges in the pharmaceutical industry to a large extent. It is possible that they could be further explored and applied in collaborations pertaining to other industries too.

The findings determined can be utilised to their complete potential if they are studied further, their combinations are tested in different settings to resolve an array of challenges presented in academic-industry collaborations in the pharmaceutical industry and the theoretical principles derived from these theories are inculcated at all levels of the academic-industry collaboration conducted, assuring that all those involved are well versed with the same.

The important factor to be derived from these findings is to understand how the themes in different theories are interconnected with one another, and how they manifest at different timelines in the collaboration. Trust is a theme that is essential throughout, along with common goals, total quality management, inter/intra organizational collaboration and stakeholder focus, which need to be applied throughout the course of the collaboration, before the collaboration begins and even after the collaborative conduct has reached its epilogue.

Knowledge sharing and networking form the backbone and the essence of the collaboration respectively and have profound implications for continuous improvement and understanding in the collaboration, greater than the other themes do, as proven earlier.

5.2 Contributions of Findings and Limitations of the Research:

The findings of this dissertation study have provided me with the conclusion that theory can be translated into practice, provided that the themes chosen are applicable individually or in combination with others to eradicate the prevalence of certain challenges in academic-industry collaborations in the pharmaceutical industry.

The findings determined by me will be essential in assisting academic and industry professionals involved in academic-industry collaborations to conduct collaborations that utilise the themes determined, and their principles explored. The collaborations conducted on a global scale will benefit from the findings produced as a result of the analysis conducted, as collaborators can assess the explored challenges and employ the determined solutions in overcoming challenges in the theories of collaboration explored.

However, the findings do have their fair share of limitations. The theories selected and the themes analysed and applied individually and in combination have been able to resolve many challenges, but there are challenges that have either not been determined yet or challenges that can arise that are novel during the course of the collaborative conduct of the academic-industry collaboration in the pharmaceutical industry.

As depicted in Figure 14, there were many themes that did not have a significant application when used in combination, despite there being a plethora of other themes that displayed promising amalgamations. Stakeholder focus was found to be weak when related to inter and intraorganizational collaboration pathways, suggesting that personal problems in the collaboration need to be addressed before addressing the problems that stakeholders have. More trust is needed between collaborators in order to address the wants and needs of stakeholders.

Another limitation found was that networking is still waning in collaborations, and new methods for supplementing this theme are urgently needed. Networking had a direct impact on total quality management, indicating that without added networking, quality of products and processes is affected, possibly due to the diminishment of other themes

simultaneously. These limitations suggest that there is a major opportunity for exploring further combinations to improve collaborations further.

5.3 Recommendations for Practice of Findings:

The findings determined in the course of this dissertation study need to be formulated and organized in a manner that brings out their true potential. The theories of collaboration identified need to be further explored in depth, applied in academia and industry individually, in order to ensure that all those involved in the collaborations between the two parties have applied the themes and principles of these theories in their operations on a daily basis.

Industry will benefit from the findings in relation to how they can use the theoretical findings and apply them in practical settings, in order to boost trust, stakeholder focus, knowledge-sharing and total quality management for establishing more reasons for them to have common goals with the industry. It is likewise for academia in terms of implementing the themes determined to be essential for conducting collaborations with academia, with an additional focus on networking with industry, in order to supplement research, grants for innovation and obtaining the best opportunities to work on projects with industry.

The themes should be inculcated in the training period for personnel and awareness of the same should be checked routinely for those involved in collaborations by experienced and knowledgeable collaborators involved in the collaboration. Lastly, the themes and principles should be inculcated in training, as part of internal audits during the collaboration and should serve as stark reminders digitally and verbally in the facilities and industries to ensure that individuals comply with the same.

5.4 Recommendations for Future Research:

The dissertation study pursued so far has focused on certain theories of collaboration that have been deemed to be the best by me at resolving challenges faced in academic-industry collaborations in the pharmaceutical industry.

Future research should focus extensively on developing new theories in line with emerging trends and arising challenges. Also, a variety of theories developed by theorists that are not directly focusing on collaboration but on the themes identified should be explored, in order to rummage through for knowledge that can be translated into a novel practice, one that has not been discovered thus far.

The idea of exploring more themes instead of merely theories would serve as a more extensively focused approach, as more specific solutions can be derived, and challenges can be overcome more profoundly in academic-industry collaborations in the pharmaceutical industry.

5.5 Final Conclusion and Reflections:

The conduct of this study has observed the determination of the challenges faced in academic-industry collaborations in the pharmaceutical industry, the theories of collaboration developed by renowned theorists, and how the theories, their themes and principles are applied in academic-industry collaborations particularly in the pharmaceutical industry.

The primary research conducted aimed at understanding the challenges faced in these collaborations, and how the themes from the theories of collaboration are related to the challenges, assessing their degree of applicability at resolving the same. It involved questioning renowned academia and industry professionals with decades of knowledge and experience in conducting academic-industry collaborations.

Their stories were coded based on the themes from the theories of collaboration and analysed with a narrative analysis approach, summarising each of their coded segment of the story in the form of how the themes identified and applied functioned in conducting academic-industry collaborations in the pharmaceutical industry.

The overall study was successful at determining the magnitude of the findings, and how future research can apply these findings to dig deeper in the quest for eradicating previous, current and future challenges faced in such collaborations.

The research conducted has provided a strong foundation for further research and application and explained deeply how certain characteristics can be derived from theories to resolve practical problems faced in academic-industry collaborations in the pharmaceutical industry.

The need to apply these in academic-industry collaborations is necessary at the ground level, ensuring that each and every person involved in academic-industry collaborations is well acquainted with these themes and principles, and the need to inculcate these to processes, networking, and technical operations at an inter and intra organizational level is an absolute must for seamlessly conducting collaborations between academia and industry.

The best theories of collaboration found in this dissertation study were selected on the basis of the number of themes each of them contributed for the eradication of challenges faced in academic-industry collaborations. The best theories of collaboration were found to be Collaboration Theory, Stakeholder Collaboration Theory and the Core Model.

These theories contained then most relevant and applicable themes, which was proved in Chapter 4 by the analysis conducted of the different themes involved, how they were combined efficaciously together to resolve challenges and the degree of applicability they had in overcoming a combination of challenges, which they overcame by the application of the vast number of themes they possessed, both individual and combinational, leading to the eradication of a vast plethora of identified challenges.

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Appendix A – Covering letter to interview subjects

Dear Sir/Madam,

I am conducting a dissertation study interview on the topic ‘What are the best theories of collaboration for conducting academic-industry collaborations in the pharmaceutical industry?’.

I would humbly request you to take part in this interview. Your participation is voluntary, and your inputs are protected under the GDPR (General Data Protection Regulation). Your opinions and identity are secured based on your discretion and will only be made public as per your consent.

Your participation would be of immense assistance for me, as it would enable me to establish the application of certain themes from theories of collaboration in academic-industry collaborations in the pharmaceutical industry.

Kindly revert back at your earliest convenience and do let me know if you wish to participate in this dissertation study. I hope to hear from you soon.

Kind regards

Appendix B – Interview questions

Q1) How many years of experience do you have in your respective field, and how has this influenced your knowledge and skills to conduct Academic-Industry Collaborations?

Q2) Could you please describe your history of being involved in such Collaborations?

Q3) Which was the most challenging aspect of being a part of such a Collaboration?

Q4) Could you please describe your most successful collaborations, and how they influenced future collaborations?

Q5) How would you describe your journey as a professional in Academic-Industry Collaborations?

Q6) Lastly, would you describe this interview as a successful transference of knowledge and experiences, one that can help other professionals in the field to overcome hurdles in the same?

Appendix C – Sample complete interview transcript

Dr. Shirish Yakkundi

Wed, 7/15 · 5:53 PM14:39

SUMMARY KEYWORDS

Industry collaboration project challenges work start-up manoeuvre academia research cork journey pharma industry company funding science Belfast problem true biomarker discovery planned

1

Speaker 1

0:00

Yeah, sure, I wanted to ask you. So, could I keep your identity in my research paper? Or would you like to keep it confidential for the research?

0:10

purposes? I mean, actually,

0:14

when you are talking about identity,

1

Speaker 1

0:16

so, I could include your name in the acknowledgement section when I when I release my thesis. Absolutely no problem. That is wonderful. Mr. Shirish,

thank you so much. I will ask you the first question. So how many years of experience do you have in your respective field? And how has this influenced your knowledge and skills to conduct academic industry collaborations?

2

Speaker 2

0:42

Okay, okay. So the amount of experience I have, so I, I normally don't consider my PhD experience, because I did work with the industry and when I was a PhD as well, but post PhD, I have 20 Two years' experience. Okay. So now what I am doing is I am a consultant to start a pharma company in first year. It is the company is into no ocular drug delivery company. Okay? Yes. And so, what I am doing is I am, I am, I am doing I am handling the projects and the operations of the company, but I am a consultant to the company. So that is so this has been only Sr 40. It will be here in in I think it will be here in September. So, I will just about a year I am with this company. So, but I am also connected with the Queen's University, Belfast School of Pharmacy. And you know, you know, I have been a visiting fellow for last seven years. And before this, I was working for a hospital in Cork. This is about last May, and I was leading biomarker discovery group. So, during that process, I was doing science, as well as I was doing industry collaboration with a small start-up with cork. So yeah, I mean, and then before that I was I was in Queens, I was working purely academic, that wasn't industry project costs or purely EU funded projects I was working quite from I would say 2000 to 2012 or 13. And then then, then there was a small bit of industry project, which I worked on. And then of course, I moved to cork and I was back, Belfast. So yes, it has been 20 years of more of a research experience. But of course, I have, I have in an exceptionally long time ago, I used to work for sip line in Mumbai. This is a long, long time ago for about couple of years. And that is, that is that I would say, was a good experience for me as well. So yeah, in and out so in into industry. See out of industry in economics for a long time came, came back to industry for a few months, and then came back into Academy. And now I am full time industry as well. So yeah, it has been in and out.

1

Speaker 1

3:11

That is wonderful. You have a particularly good experience of both the sides in that case.

3:17

Yeah, yeah.

1

Speaker 1

3:18

That is great. So, I would like to ask you, Mr. Shirish, what has been the most challenging aspect of being part of such a collaboration on either side?

2

Speaker 2

3:28

I think the challenge gets us quite a few challenges. So, the first thing which I can see clearly now is that, you know, when you work for industry, it is a very streamlined process. And because of working for a start up, you know, the investors are investing money to get a product out of us. So, there's extraordinarily little room to wiggle around, if you want to do some extra science papers. So, what as a scientist what I missed in industry is It is quite regulated. So even if you want to order something, you have to really go through few steps to get the management involved and say, I am trying to do this because I want to see what's, what's going to happen. But sometimes, the management says no, no stick to what we have planned. So, it is a very tiny room of riddling, especially with start-ups. You know if you if you are grown a pharma company, that is fine, you have R&D division. So, with start-ups is difficult. So, we have already whether we are Novus is spun out of R&D, our work has anyway. But then once it has been out, and once investors have invested right so it has it, you cannot change too many things. So that is that is the challenge. But with the, with the industry. The challenging bit with the

Academy is fantastic work in academia, you have so much scope of doing lots of research, doing different activities, and you can always plan something thing in the middle of a project, he can do something else. But challenges, you know, have to depend on the funding available. So, you can only get three years project that does not mean that project will be extended for another three years, you have to apply for funding. So, academia, the challenges to funding better with the COVID-19 situation is going to get worse as well. So, they have been both put both the both industry and academics have their own positives. And then of course, both have the challenges. They are not I would say, 50-50, that they are exactly the same percentage wise, but in those different angles, we would say. Yeah, so it has been it has been Yeah, I mean, I have worked in academia for a long time and I know how grants works. How you know how, how people struggle once the you know, the project is finished, and if we don't have anything else lined up, and if they don't get an extension of grants So, and of course, then people try to move into another university for another research grant or you know, the track to get into the industry. Whereas people in industry again, there is no safety net industry these days, especially with start-ups or even the big pharma company. The challenges there would be, you know, layoff if there is the jobs, you know, being lost, because of whatever reason, but I have not heard any much negative news from pharma industry as especially in this COVID era where people have still held up to the jobs and I think the thing they probably might need more people in in pharma now, because of, you know, a lot of useless deeming they wouldn't have happened in vaccines and everything. So, it is the main the main challenges our industry is that you know, it is very regulated, and which is fantastic. You need regulation. Otherwise As you know, you will not you will not be able to succeed as a businessman. And that is what investors look like. They do not like to change too many things. They do not like too much of manoeuvring within the projects. And on the flip side is, you know, sciences like in, in academia, you have so much room to manoeuvre, you have to do a lot of things. But then then the limitation is the, you know, the funding issue in the academy.

1

Speaker 1

7:24

Absolutely. I think you are, you are very right, Mr. Shirish. There are a lot of problems in that sense in academia now on that side of the industry.

7:33

Oh, yeah. It is an it is

2

Speaker 2

7:35

the problem is, you know, it is, it is because it is totally funded by you know, you know, either government or funding bodies or, you know, all this stuff. And now with the current situation, I do not think so. The government will have the option per policy now the country they could fund everyone. They cannot fund every project. Because they already spent so much money on COVID research. So the coming days are going to be a bit tough for, you know, people, I mean, it's not going to be that difficult, you know, people can manoeuvre around, they can change products projects, they can change jobs. I think pharma industry will definitely boom quite a bit in next 10 years, for whatever reasons. So yeah, I mean, challenges plus positives. That is the take home message, I would say.

1

Speaker 1

8:34

Absolutely true, Mr. Shirish. I will ask you the next question. So, could you please describe your most successful collaboration and how did that influence your future collaborations?

2

Speaker 2

8:46

Yeah, so my most successful collaboration was when I was in Cork, and I was collaborating

8:54

with the industry.

2

Speaker 2

8:56

It is called Walters Corporation, and they are based in Manchester They're technically they are basically into manufacturing. You know, HP, OCS and mass spec have a project. We know, that right? Yeah, you know, as closely as possible. Yeah. So analytical instruments. Yeah. So, they are not instrumenting. So, that was the best project we had industry project. So again, that was the best example of industry academia collaboration, where I would suggest would have had free hand of tooling, science of course with input from industry number one, but Terra had a bit of more space to manoeuvre bit of more space to do different things in science so and that I would I would base of our one of my best collaborations in my life until now. And that is the instrument I mean, I think. Also, this collaboration has always succeeded when both the parties academia and industry work very closely. Okay. No. Crew working very diligently working very closely scientifically, exchanging the knowledge exchanging, you know, challenges and be upfront at every, every, every, every step of the projects. And that is what we did. And it was really a fantastic collaboration.

1

Speaker 1

10:21

Wonderful, I think, yes, you are totally right about this. So that trust is especially important to have in collaboration along with good communication and programmes for knowing each side of the collaboration.

2

Speaker 2

10:38

Which of course, everyone knows it, but you will be learning the awfully hard way is, you know, any project of any collaboration, you have to be incredibly open. And then if you see challenges at the start, at any stage, it's best to communicate straight away and tell this is this has happened when we trying to innovate refi but just to let you know, I know that this has happened. And if you have any suggestions how to go about, you know, we are trying to space or at least you know, you keep your partner you know, posted rather than leaving at the last minute. And then things just come down and you know, the trust factor has gone down the drain, and then they do not want it. They do not like to collaborate just not with us but with any person in academia because you have lost interest and they lost trust.

11:28

Exactly. Absolutely true.

1

Speaker 1

11:32

Yes, Mr. Shirish I shall ask you the next question. So, how would you describe your journey so far as a professional in academia? industry collaborations?

2

Speaker 2

11:42

Yeah, it has been it has been it has been fantastic. Not without any challenges, but I would say it has been a great, great journey. I have met a lot of wonderful, brilliant intelligent people. And a lot of catalyst two or three. I got my mentors. I was tracking this journey and people who actually told me how to go about few things when I was in earlier stage of my research journey has been great. And the journey has been very smooth, special for me touchwood that you know, things have been when I moved from industry Academy on a career path to dentistry now it's been a great journey I know

what happens is along the line you make a lot of friends I know mentors and friends and mentors become friends later on and you know we that that's the best part where they can chip in in your life and tell you what is good, what is not good. And we are also the other bit of insert it's always a tough one to and from way of dealing with things because then they will need our help. So, for example, my last collaboration retired, you know, which was phenomenally successful one and I had not been consulted now. So, we needed something Help for the company. And I just picked up the phone. And they said no, absolutely no problems. You know, they, they did a walkthrough for me, which was a small bit of work. But you know, the contacts which we make on the India journey is amazing. You should never ever lose any contact in that journey. Because everyone will be helpful in one way or the other in your life. So yeah, that is the thing.

1

Speaker 1

13:24

Absolutely, yes. Networking is the most important thing in collaborations I feel because that is how you work as a team. And that is how you get the output that has been planned.

13:34

Yes, exactly. Exactly.

1

Speaker 1

13:36

That is great. So, I would like to ask you the last question. So, would you describe this view as a successful transference of knowledge and experiences? And would you think this would be helpful to other professionals in the field?

2

Speaker 2

13:50

Oh, yes, absolutely. Yes, I think so. You are absolutely right. This is really extremely helpful for the other professionals in the field. So how many cities Have a specific number here to cover.

1

Speaker 1

14:02

I guess I would have to cover for people on each side for from the academic side and for people from the industry side.

2

Speaker 2

14:10

Okay, okay. Okay. Yes, size small company

1

Speaker 1

14:15

or the size actually sorry a minimum that has been asked by my supervisor. He said you can go beyond that. But our problem is that getting industry people is a little difficult because everyone is remarkably busy.

14:27

Sorry.

14:31

Yes, sir.

14:33

But anyway, good, good. I would suggest Yeah, absolutely. I think that is that what you are doing is fantastic.

Appendix M – Results

Figure 12: MAXQDA Code Map of Relations

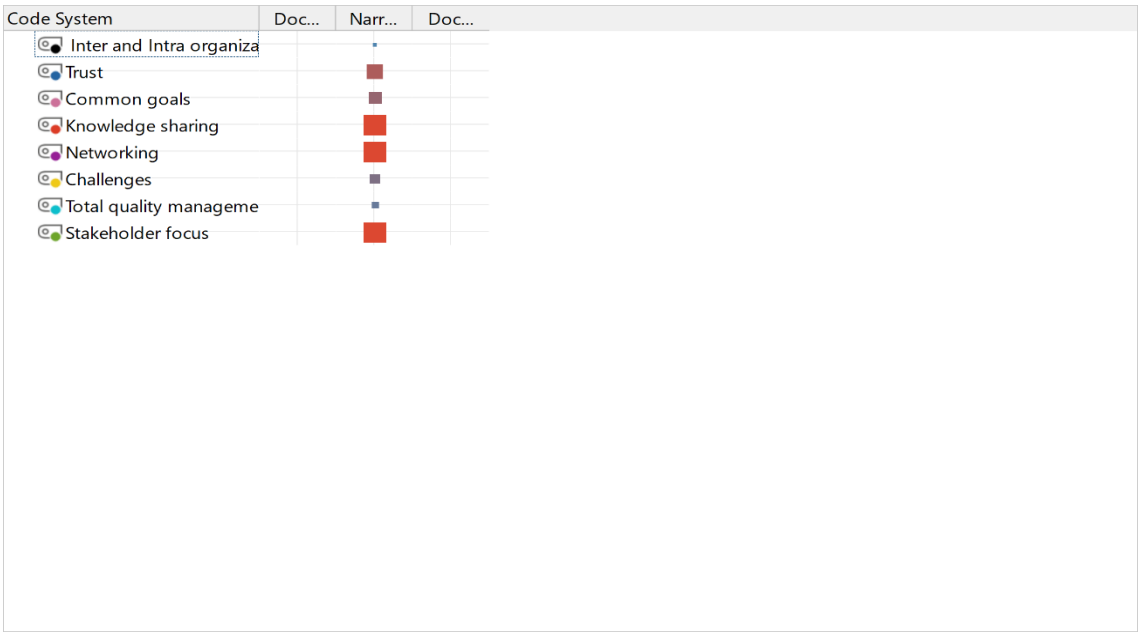

Figure 13: MAXQDA Code Prevalence distribution

Appendix N – Data analysis

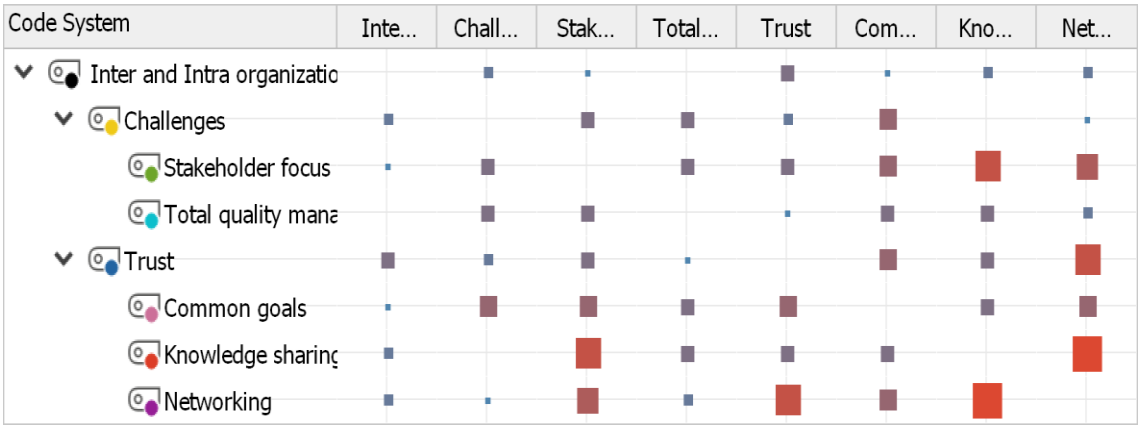

Figure 14: Code relations analysis

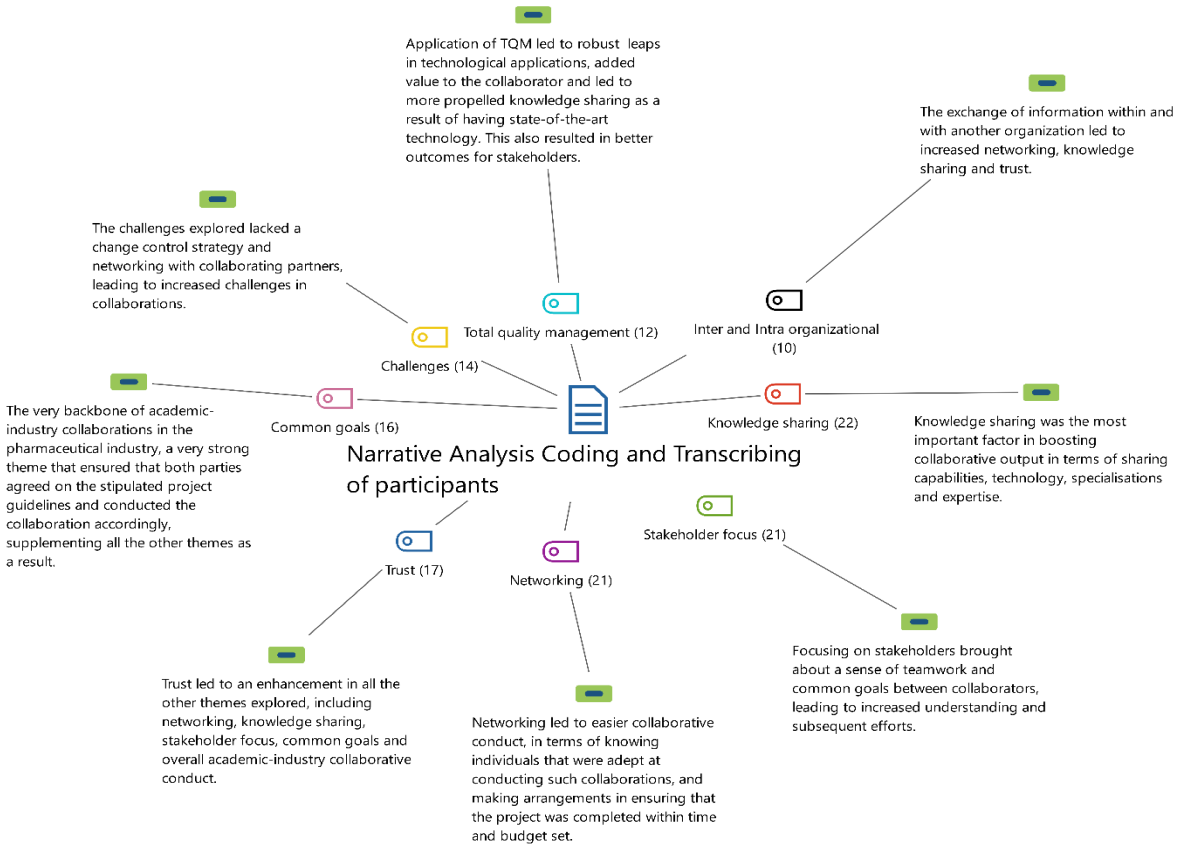

Figure 15: Narrative analysis of codes generated

O

P

Q